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Mill Creek Area, Jefferson County, Kentucky

Gannett Fleming Corddry and Carpenter, Inc.
Harrisburg, PA

Prepared for

Environmental Protection Agency
Atlanta, GA

Sep 81

U.S. Department of Commerce
National Technical Information Service
NTIS

PB82-130691

United States
Environmental Protection
Agency

Region 4
345 Courtland Street, NE
Atlanta, GA 30365

EPA 904/9-81-079
September 1981

EPA

Environmental Impact Statement

Draft

Mill Creek Area
Jefferson County, Kentucky

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This draft EIS addresses proposed wastewater facilities for the Mill Creek Area of southwest Jefferson County, Kentucky. Numerous wastewater management alternatives ranging from complete reliance on existing on-site systems to a full regional system were evaluated in this EIS. At issue in the Mill Creek Area EIS is the need for EPA to provide Federal funds for sewer service to residential areas currently served by individual on-lot systems and the provision of sewer service to the Louisville-Jefferson County Riverport Industrial Park.

The Draft EIS preferred alternative involves a limited sewer alternative in which the Dixie Highway commercial strip and most, if not all, of the 26 small wastewater treatment plants will be served by a limited sewer. It is proposed that residential areas now served by on-lot systems in the Mill Creek area will remain on these systems.

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IV
345 COURTLAND STREET
ATLANTA, GEORGIA 30365

September 16, 1981

NOTICE OF PUBLIC HEARNG

TO ALL INTERESTED GOVERNMENT AGENCIES, PUBLIC GROUPS AND CONCERNED CITIZENS:

The United States Environmental Protection Agency (EPA) will hold a public hearing on Tuesday, November 17, 1981, to receive public and agency comments on the Mill Creek Area, Jefferson County, Kentucky Draft Environmental Impact Statement (EIS). The Mill Creek Area Draft EIS addresses proposed wastewater facilities for southwest Jefferson County, Kentucky.

The public hearing will be held November 17, 1981, at 7:30 p.m. in the Pleasure Ridge Park High School located at 5901 Greenwood Road, Pleasure Ridge Park, Kentucky.

Both written and oral comments will be accepted and a transcript of the hearing will be made. Lengthy or technically complex statements should be summarized for the oral presentation. If possible, copies of the statements should be presented prior to the oral presentation. The Hearing Officer reserves the right to fix reasonable limits on the time allowed for oral statements.

A Final EIS will be published after the close of the Draft EIS public comment period. EPA does not intend to reprint the entire Draft EIS as part of the Final EIS. The Final EIS will consist of the Agency's decision, a summary of the Draft EIS, any pertinent additional information or evaluations developed since publication of the Draft, revisions to the Draft, comments received and EPA's responses, and the transcript of the public hearing. A copy of the Draft EIS should be retained if a complete evaluation of the project is desired.

The hearing record will remain open and additional written comments may be submitted until December 4, 1981. All additional comments that are received during the comment period will be considered as part of the hearing record.

Draft
Environmental Impact Statement

Mill Creek Area
Jefferson County, Kentucky

U.S. Environmental Protection Agency
Region IV
Atlanta, Georgia 30365

This Draft EIS addresses proposed wastewater facilities for the Mill Creek Area of southwest Jefferson County, Kentucky. Numerous wastewater management alternatives ranging from complete reliance on existing on-site systems to a full regional system were evaluated in this EIS. At issue in the Mill Creek Area EIS is the need for EPA to provide Federal funds for sewer service to residential areas currently served by individual on-lot systems and the provision of sewer service to the Louisville-Jefferson County Riverport Industrial Park.

The Draft EIS preferred alternative involves a limited sewer alternative in which the Dixie Highway commercial strip and most, if not all, of the 26 small wastewater treatment plants will be served by a limited sewer. It is proposed that residential areas now served by on-lot systems in the Mill Creek area will remain on these systems.

The comment period for the Draft EIS will remain open until December 4, 1981. Comments or inquiries should be forwarded to:

John E. Hagan III, P.E.
Chief, EIS Branch
EPA, Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365
404-881-7458

Approved by

Aug 13, 1981

Charles R. Jeter
Regional Administrator

Date

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV ATLANTA, GEORGIA

DRAFT
ENVIRONMENTAL IMPACT
STATEMENT

for

The Mill Creek Area, Louisville-Jefferson County, Kentucky

September 1981

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PREFACE

This report is one of the documents prepared for the environmental impact study on wastewater disposal practices in the Mill Creek area of Jefferson County, Kentucky, and is based on a series of task reports that have been completed over the past two years:

Project Background Task Report	November 1979
Alternatives Development Task Report	February 1980
Environmental Inventory Task Report	June 1980
Groundwater Studies Task Report	June 1981
Alternatives Evaluation Task Report	June 1981

Several points regarding this Environmental Impact Statement (EIS) should be stressed at this time.

1. The EIS was prepared by the U.S. Environmental Protection Agency (EPA). Technical input was provided by a prime contractor and several subcontractors.

2. The purpose of the EIS is to provide a firm technical basis for selection of wastewater management practices in the study area. All reasonable alternatives have been reviewed.

3. Selection of a wastewater management system as the EPA-proposed action will be made by the Regional Administrator, EPA Region IV.

In accordance with federal policy, the metric system is used in this report for expressing units of measure; equivalent measurements in the English system are given in parentheses. Exceptions to this rule occur when measurements have been specified in English units in legal or regulatory documents, when standard billing charges are expressed in English units, and when standard construction material sizes are specified in English units. Such measurements are introduced here as English units with the metric units given parenthetically, but thereafter the metric units are used as the primary means of expression. For reference, abbreviations and equivalencies of the units used in this report are listed on the following page.

1 inch (in.) = 2.54 centimeter (cm)	1 cm = 0.394 in.
1 foot (ft) = 0.305 meter (m)	1 m = 3.28 ft
1 mile (mi) = 1.61 kilometer (km)	1 km = 0.621 mi
1 square foot (ft^2) = 0.0929 square meter (m^2)	1 m^2 = 10.76 ft^2
1 acre (ac) = 0.405 hectare (ha)	1 ha = 2.47 ac
1 foot per second (fps) = 0.305 meter per second (m/s)	1 m/s = 3.28 fps
1 cubic foot per second (cfs) = 0.0283 cubic meter per second (m^3/s)	1 m^3/s = 35.3 cfs
1 gallon (gal) = 3.79 liter (L)	1 L = 0.264 gal
1 million gallons per day (mgd) = 3,790 m^3/d	1 m^3/d = 0.000264 mgd
1 pound (lb) = 454 gram (g)	1 g = 0.00220 lb
1 lb = 0.454 kilogram (kg)	1 kg = 2.20 lb
1 gallon per minute per square foot (gpm/ft^2) = 0.679 liter per square meter per second (L/m^2/s)	1 L/m^2/s = 1.473 gpm/ft^2
1 gallon per day per square foot (gpd/ft^2) = 0.0407 cubic meter per square meter per day (m^3/m^2/d)	1 m^3/m/d = 24.6 gpd/ft^2
1 pound per thousand square feet (lb/1000 ft^2) = 4.88 gram per square meter (g/m^2)	1 g/m^2 = 0.205 lb/1000 ft^2
1 pound per thousand cubic feet (lb/1000 ft^3) = 16.0 gram per cubic meter (g/m^3)	1 g/m^3 = 0.0624 lb/1000 ft^3
1 pound per horsepower per hour (lb/hp/h) = 0.608 kilogram per kilowatt-hour (kg/KWH)	1 kg/KWH = 1.64 lb/hp/h

1 horsepower per thousand cubic feet (hp/1000 ft^3) = 26.3 watt/cubic meter (W/m^3)	1 W/m^3 = 0.0380 hp/100 ft^3
1 dollar per ton ($/ton) = 0.001102 dollar per kilogram ($/kg)	1 $/kg = 907 $/ton
1 ton per acre per year (ton/ac/yr) = 2,240 kilogram per hectare per year (kg/ha/yr)	1 kg/ha/yr = 0.000446 ton/ac/yr

EXECUTIVE SUMMARY FOR ENVIRONMENTAL IMPACT STATEMENT

MILL CREEK AREA, LOUISVILLE-JEFFERSON COUNTY, KENTUCKY

Draft (X)
Final (   )

Environmental Protection Agency
Region IV
345 Courtland Street
Atlanta, Georgia 30365

Type of Action: Administrative Action (X)
Legislative Action (   )

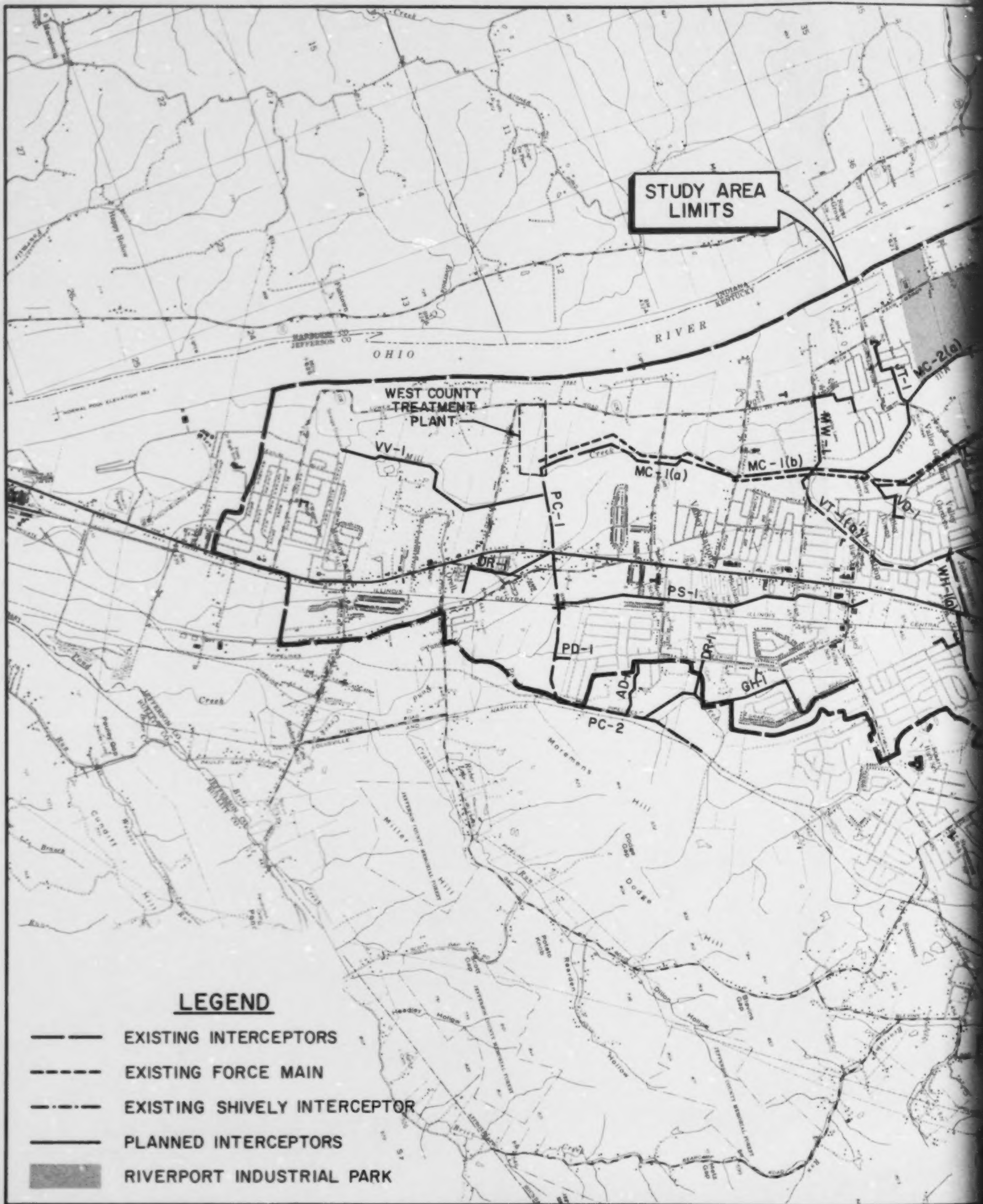
1. EXECUTIVE SUMMARY

1.1 Existing Problem

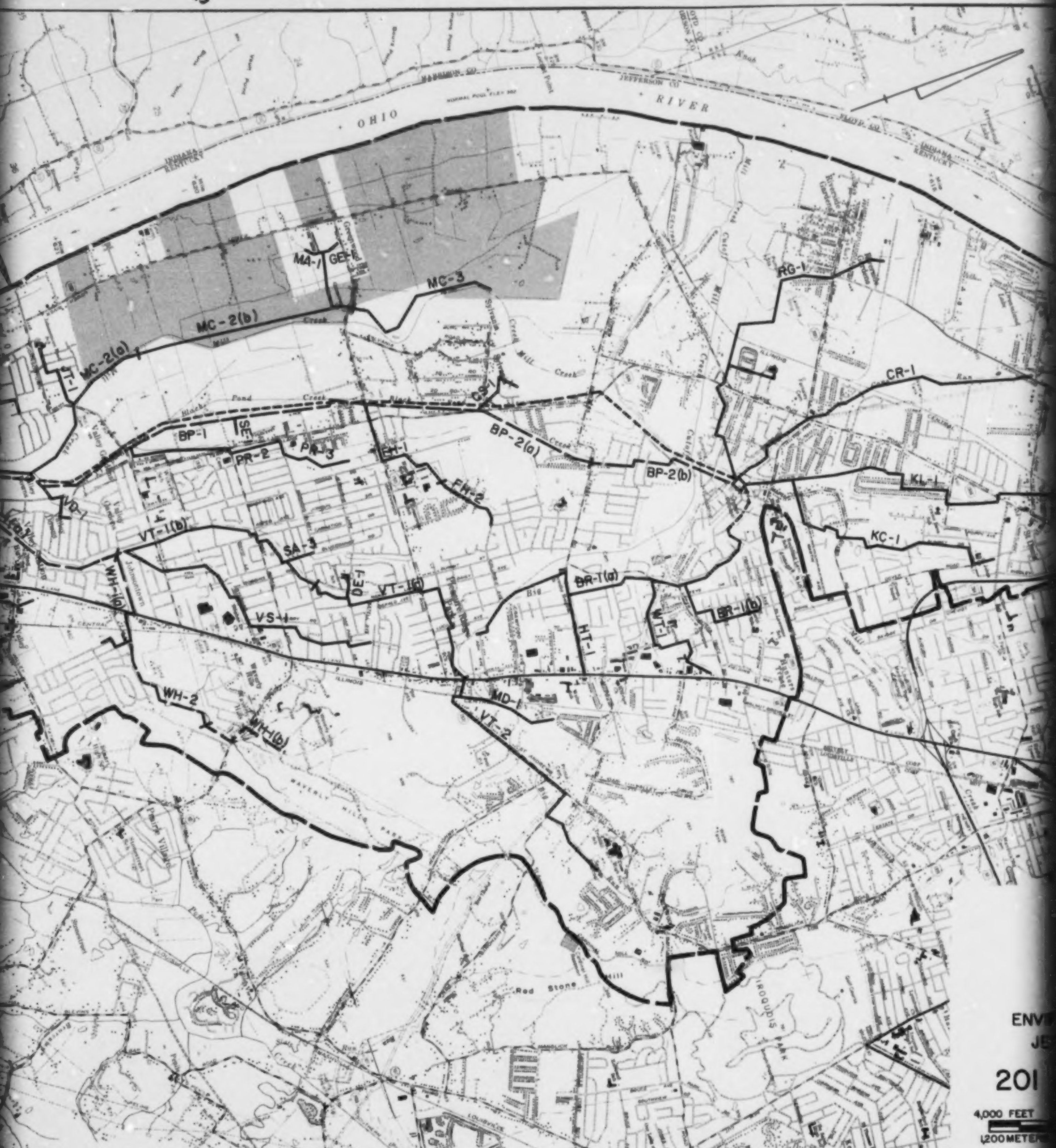
The 1974 Water Quality Management Plan (201 Plan) for metropolitan Louisville recommended that the Mill Creek area in southwestern Jefferson County be served by a regional sewerage system. The system would relieve all existing septic tank-seepage pit systems and small-area wastewater treatment plants. The West County Wastewater Treatment Plant would be built to serve the Mill Creek and Pond Creek areas, Shively, and part of Louisville now served by the Morris Forman Treatment Plant. Several segments of the 201 interceptor system have since been built (Figure 1) and design of the West County plant is under way.

In March 1977 the Southwest Jefferson County Homeowners Association wrote to the President's Council on Environmental Quality and EPA requesting an EIS on the 201 Study. In January 1978, the Homeowners Association filed suit in U.S. District Court to enjoin EPA and MSD from further implementing the 201 Plan. The concerns raised by area residents were many, but basically they were:

1. Area septic tank systems are now adequately serving the needs of the community and sewers are not needed.
2. The cost of sewers to area homeowners would be high ($2,500-$3,000 hook-up plus monthly charge) and constitutes an unnecessary burden since the on-site systems are functional.
3. Public sewer service should not be provided to the proposed Riverport Industrial Park.


STUDY AREA LIMITS
WEST COUNTY TREATMENT PLANT
OHIO
RIVER
INDIANA
KENTUCKY
VV-1
MC-1(a)
MC-1(b)
MW-1
JT-1
MC-2(a)
VT-1(a)
VD-1
PC-1
DR-1
PS-1
WH-1(a)
PD-1
ADA
DR-1
GH-1
PC-2
ILLINOIS
CENTRAL
NASHVILLE
Moremens Hill
Dodge Hill
LEGEND
EXISTING INTERCEPTORS
EXISTING FORCE MAIN
EXISTING SHIVELY INTERCEPTOR
PLANNED INTERCEPTORS
RIVERPORT INDUSTRIAL PARK

B



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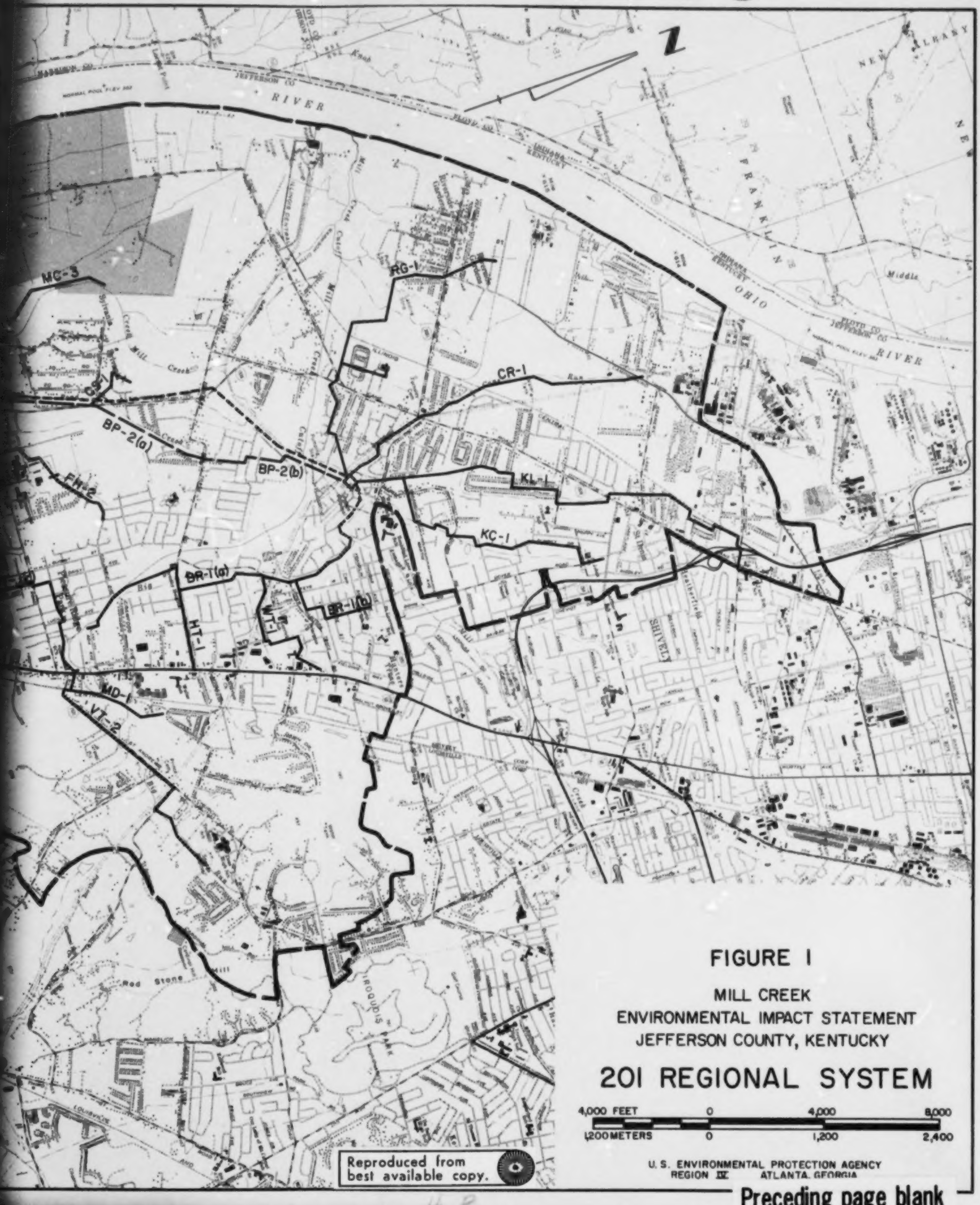

FIGURE I

MILL CREEK
ENVIRONMENTAL IMPACT STATEMENT
JEFFERSON COUNTY, KENTUCKY

201 REGIONAL SYSTEM

4,000 FEET 0 4,000 8,000
1,200 METERS 0 1,200 2,400

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REGION IV ATLANTA, GEORGIA

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4. The assumption that a regional sewerage system will more adequately protect the environment is questionable.

In September 1977, EPA issued a Notice of Intent to prepare an EIS for the Mill Creek service area. The EIS Notice of Intent was reissued and a Negative Declaration for the West County Treatment Plant and the Pond Creek sewerage system was issued in May 1978.

1.2 Description of Alternatives

The Mill Creek area is currently served by two wastewater management systems: individual on-site systems or sewers flowing to small package plants. At this time, over 20,000 on-site systems (septic tank-seepage pits) are used throughout the study area. The sewered population is served by 26 package plants with an aggregate design flow of about 2 million gallons per day. A range of alternatives from no-federal-action to a regional system has been evaluated in the EIS. In describing these alternatives, 3 population components have been considered: (1) population presently sewered, (2) population presently served by septic tanks, and (3) future population. These alternatives have been evaluated and eight alternatives remain as reasonable alternatives. These eight alternatives are briefly summmarized in Table 1. Alternative 6 is the 201 regional system (see Figure 1); alternative 9 is the no-federal-action scenario. Alternatives 2a and 2b would incorporate the same facilities now in use - the existing small treatment plants shown in Figure 2 and Table 2 and existing septic tank systems - plus future on-site systems. Alternatives 7a, 7b, and 7c involve basically the same physical features (Figure 3) sized differently according to the amount of future capacity included. Alternatives 7a and 7b are sized to handle existing flows from the Dixie Highway corridor and several nearby package plants. Alternative C is sized as if it were the initial phase of a regional system. Alternative 8 (Figure 4) represents the first phase of the 201 regional system.

1.3 Evaluation of Alternatives

During the evaluation process of system alternatives, several elements were identified as being significant to the decision process. For the purpose of comparing alternatives and highlighting the relative strengths or weaknesses of the alternatives, the following evaluation categories have been selected for discussion: cost, public acceptance, public health, water quality and financial implementability. The evaluation of each alternative with respect to these categories (except financial implementability) is summarized in Table 3.

1.3.1 Cost

Table 3 demonstrates significant differences for the alternatives in the total present worth costs ($27 million to $90 million) and the cost to the area homeowners. For the regional system, homeowners now using on-lot systems could expect a sewer connection charge of at least $3,000 and a charge of approximately $120 per year. There would also be the additional charge of household plumbing changes necessary to tie into the system.

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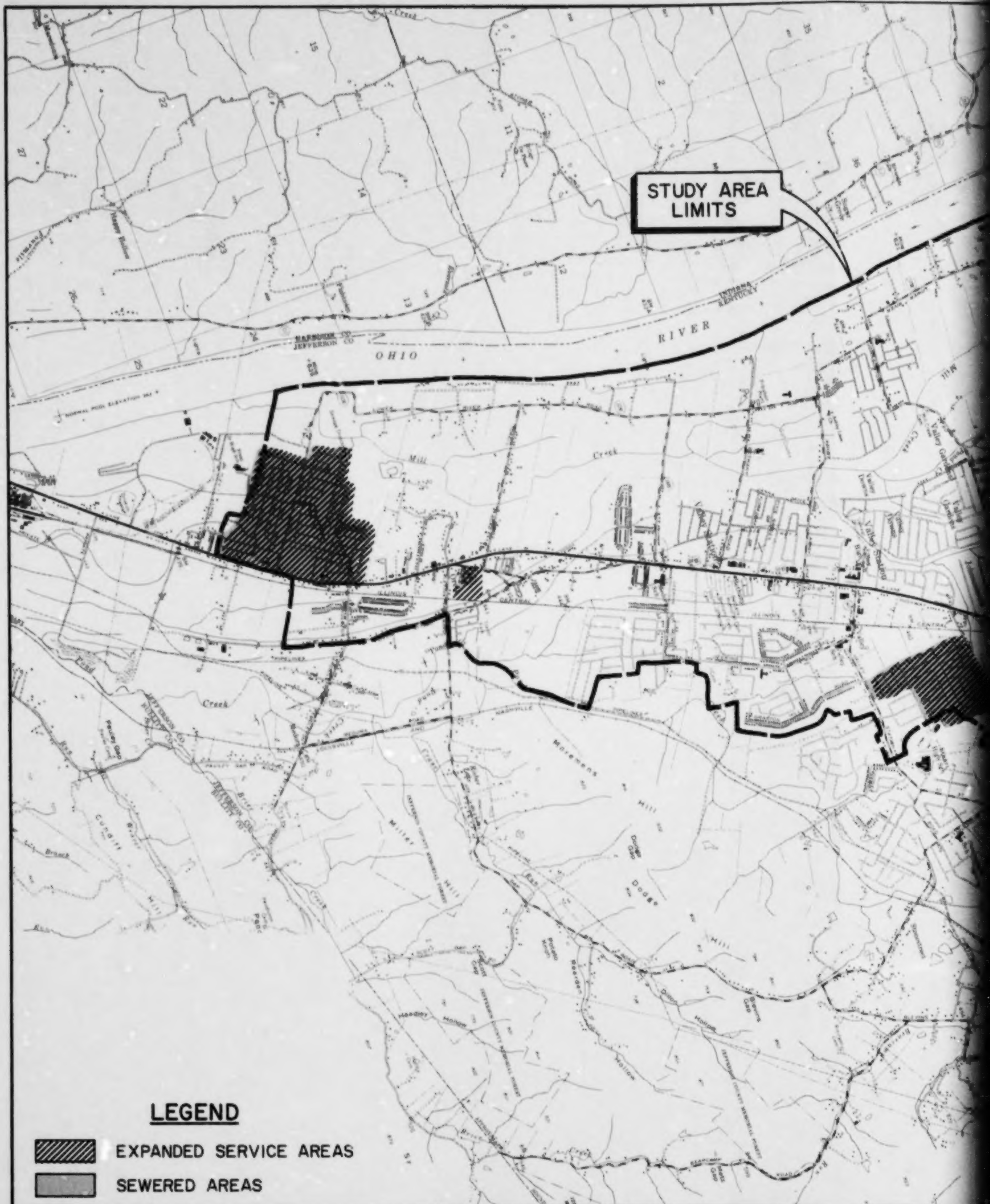
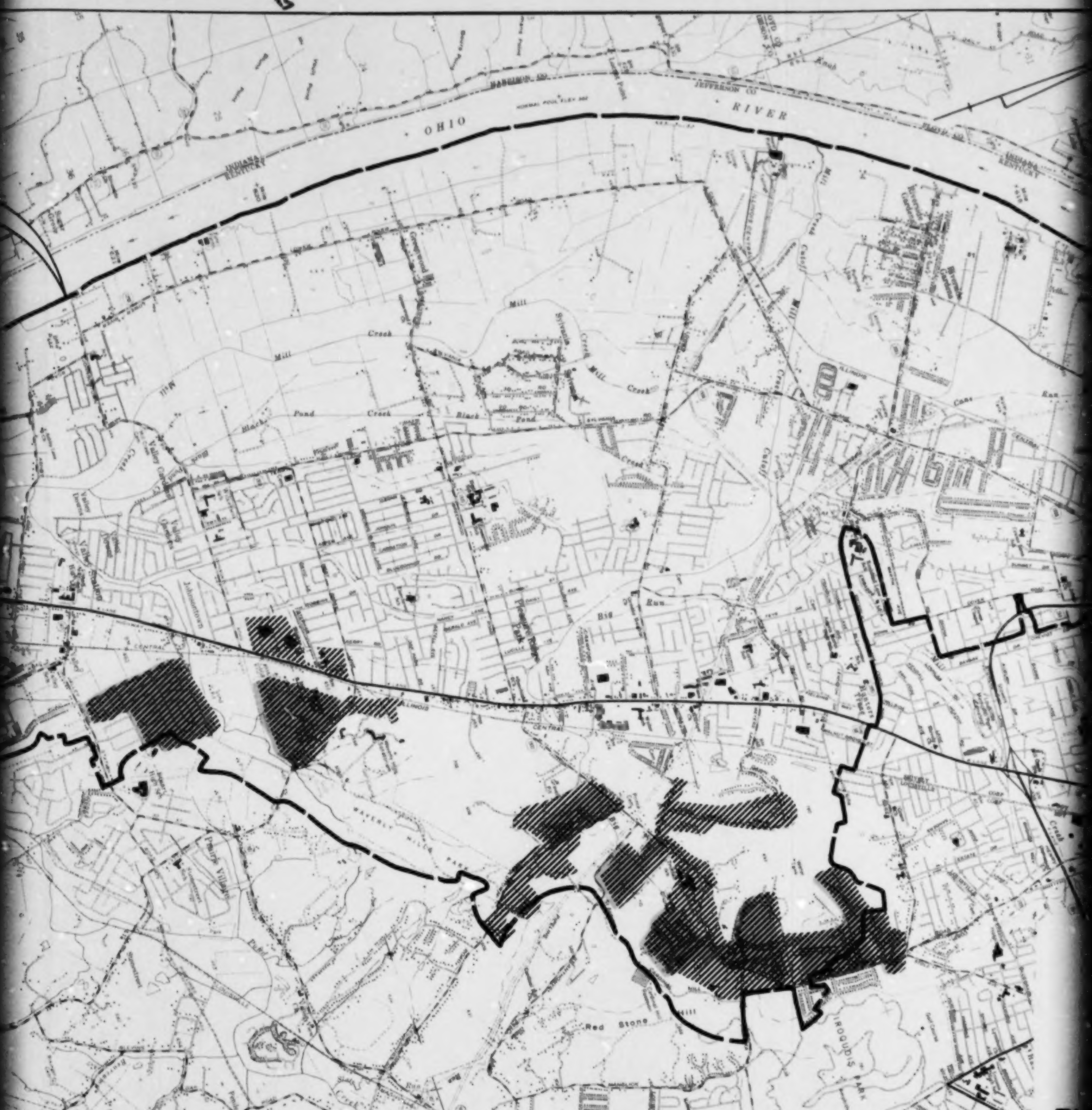
TABLE 1. WASTEWATER MANAGEMENT ALTERNATIVES

Alternative	Population Presently Served by Small Treatment Plants (WWTPs)	Population Presently Served by Septic Tanks	Future Population
2a	Continue use of WWTPs	Continue use of septic tanks	Use septic tanks or connect to existing interceptor system
2b	Continue use of WWTPs	Connect to WWTPs those dwellings in natural drainage area; continue use of septic tanks for others	Connect to WWTPs those dwellings in natural drainage area; use septic tanks or connect to existing interceptor system for others
6	Abandon WWTPs; connect to regional conveyance and treatment system	Connect to regional conveyance and treatment system	Connect to regional conveyance and treatment system
7a	Abandon some WWTPs and connect to limited regional system; continue some of other WWTPs	Connect to limited regional system the businesses along Dixie Hwy; continue use of septic tanks for others	Connect to existing or new WWTPs or connect to existing interceptor system
7b	Abandon some WWTPs and connect to limited regional system; continue use of other WWTPs	Connect to limited regional system the businesses along Dixie Hwy; continue use of septic tanks for others	Use septic tanks or connect to existing interceptor system
7c	Abandon some WWTPs and connect to limited regional system; continue use of other WWTPs	Connect to limited regional system the businesses along Dixie Hwy; continue use of septic tanks for others	Connect to limited regional system
8	Abandon some WWTPs and connect to first phase of 201 regional system; continue use of other WWTPs	Connect to first phase of 201 system the businesses along Dixie Hwy; continue use of septic tanks for others	Connect to 201 regional system
9	Continue use of WWTPs	Continue use of septic tanks	Connect to existing or new WWTPs or connect to existing interceptor system

A


STUDY AREA LIMITS
INDIANA
KENTUCKY
HARRISON CO
JEFFERSON CO
OHIO
RIVER
NORMAL POOL ELEVATION
Mill
Creek
ILLINOIS
CENTRAL
Mill
Creek
Valley
Hill
Dodge
Hill
Headley
Hollow
LEGEND
▨ EXPANDED SERVICE AREAS
▒ SEWERED AREAS

B



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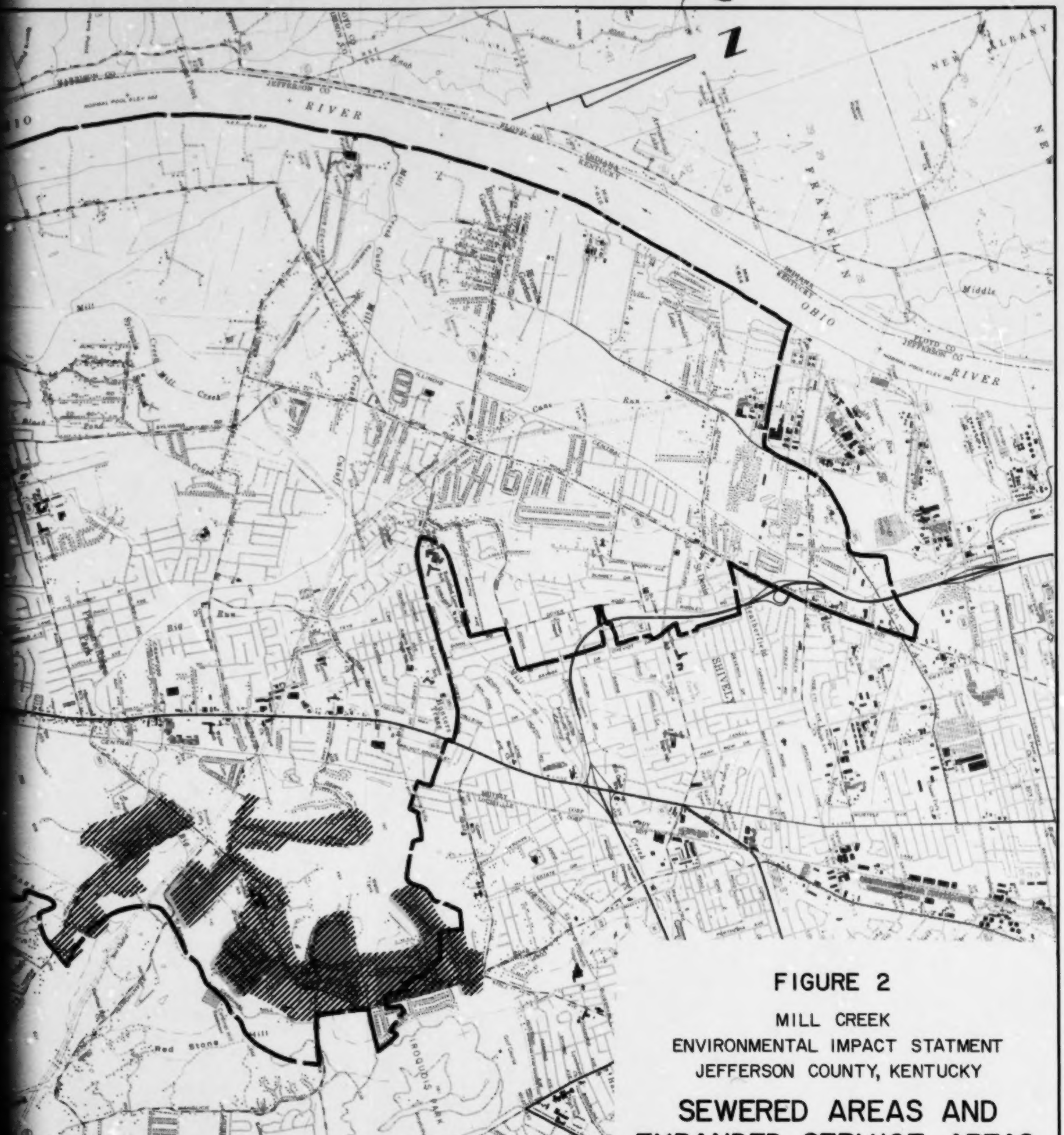

FIGURE 2

MILL CREEK
ENVIRONMENTAL IMPACT STATMENT
JEFFERSON COUNTY, KENTUCKY

SEWERED AREAS AND EXPANDED SERVICE AREAS

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REGION IV ATLANTA, GEORGIA

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TABLE 2. SMALL-AREA WASTEWATER TREATMENT PLANTS

1. Valley Village Subdivision
2. Valley High School
3. Villa Anna (MSD)
4. Beth Haven Baptist Church
5. Sanders Elementary School
6. Westland Mall
7. Timothy Hills Subdivision
8. Eden Apartments
9. Eisenhower Elementary School
10. Waverly Hills Apartments
11. Pleasure Ridge Park High School
12. Conway Middle School
13. S. W. Jefferson County Government Center
14. Shacklette, Wade School
15. R & W Laundromat
16. Havalock Subdivision
17. Silver Palms Swim Club
18. Cardinal Mobile Home Park
19. Fordhaven Subdivision
20. West Springfield Subdivision
21. Forest Hills Subdivision
22. Kerrick Elementary School
23. Wellington, Sara Belle School
24. River Valley Mobile Home Park
25. Johnsontown Elementary School
26. Woodhaven Medical Services

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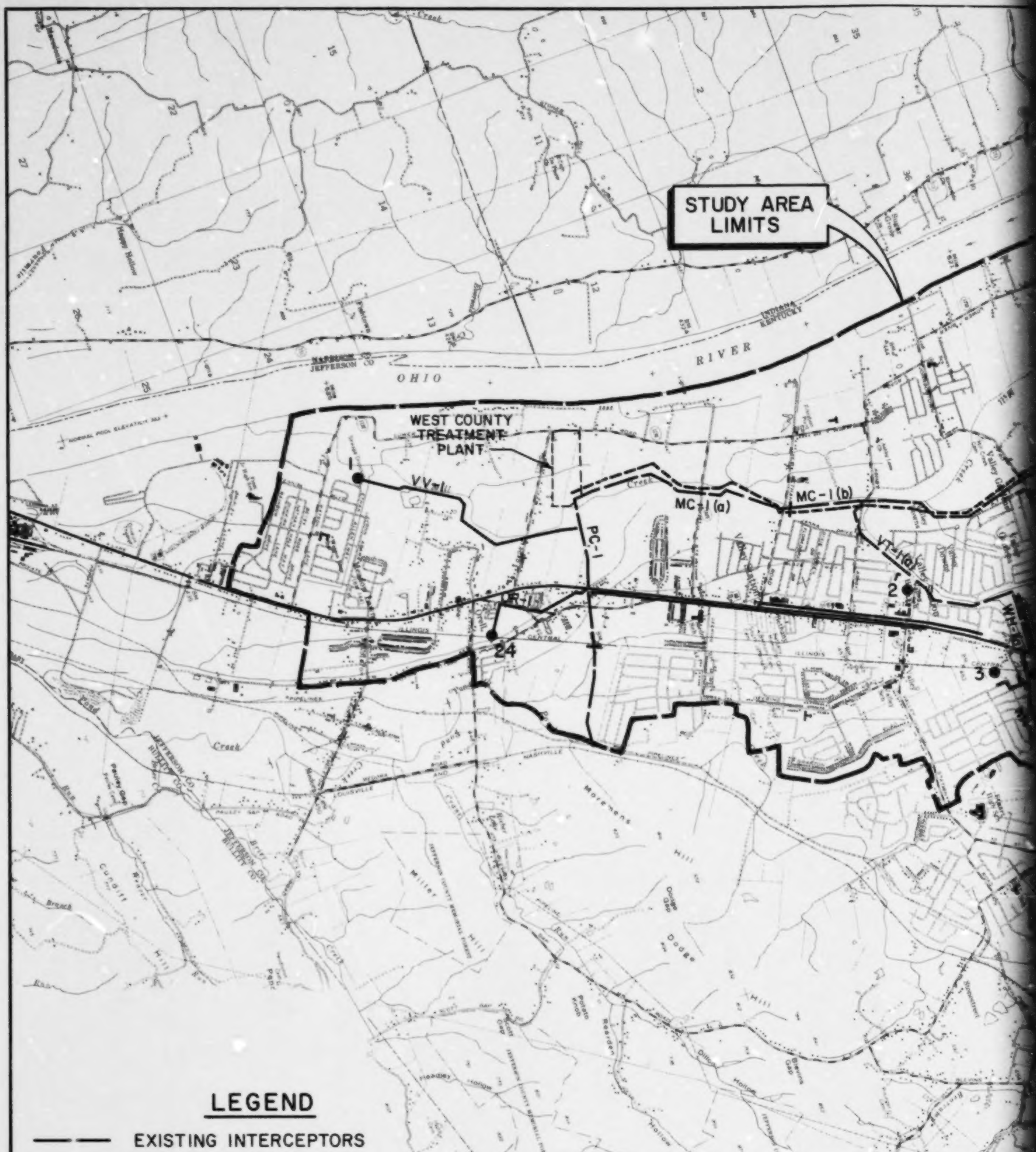
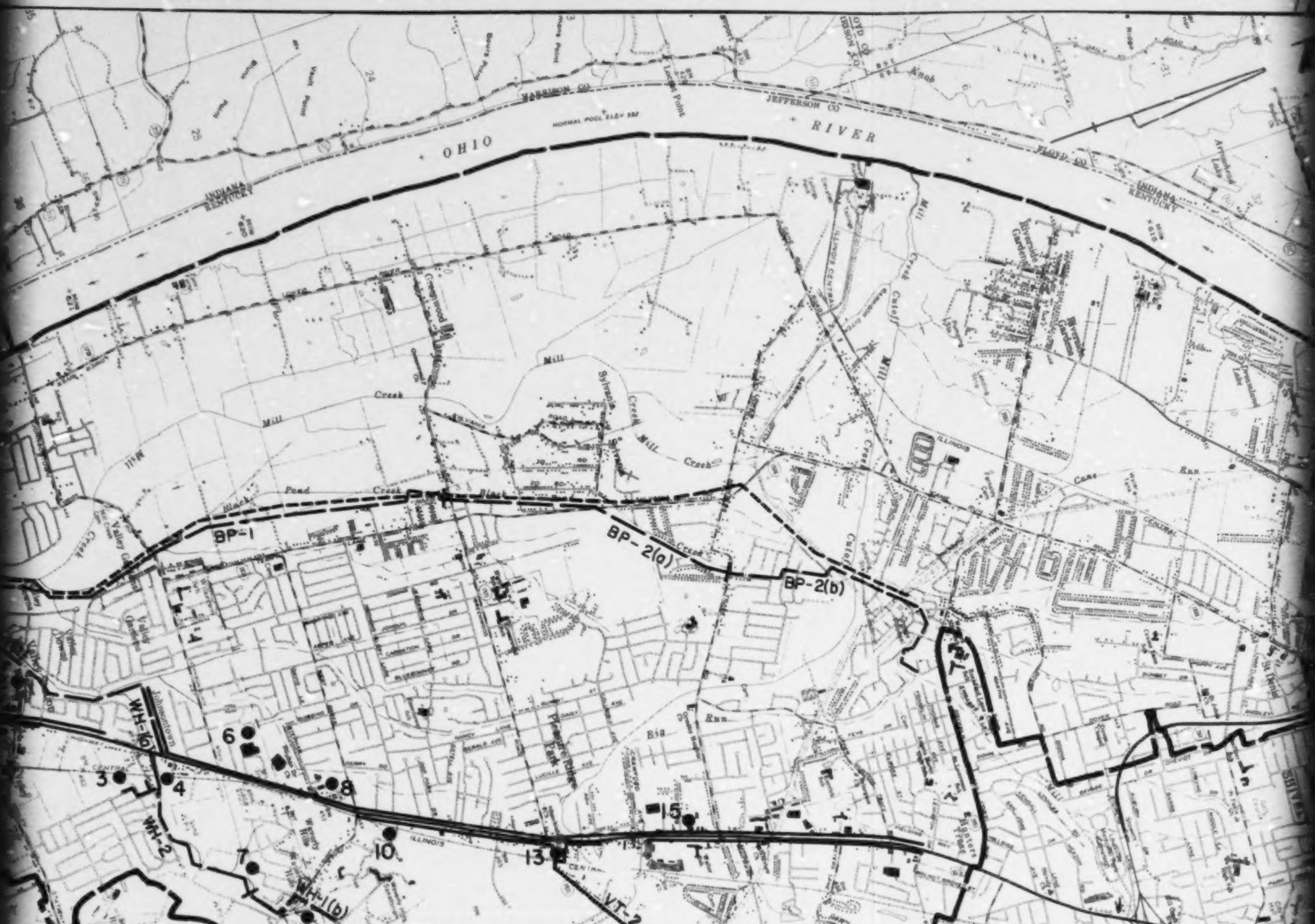

STUDY AREA LIMITS
WEST COUNTY TREATMENT PLANT
OHIO
RIVER
INDIANA
KENTUCKY
HARRISON CO
JEFFERSON CO
1
VV-1(a)
MC-1(a)
MC-1(b)
PC-1
OR-1
VT-1(a)
WH-10
2
3
24
Creek
Pond
Miller
Hill
Dodge
Moremens
LEGEND
EXISTING INTERCEPTORS
EXISTING FORCE MAIN
PLANNED INTERCEPTORS
●6 TREATMENT PLANTS TO BE RELIEVED

A



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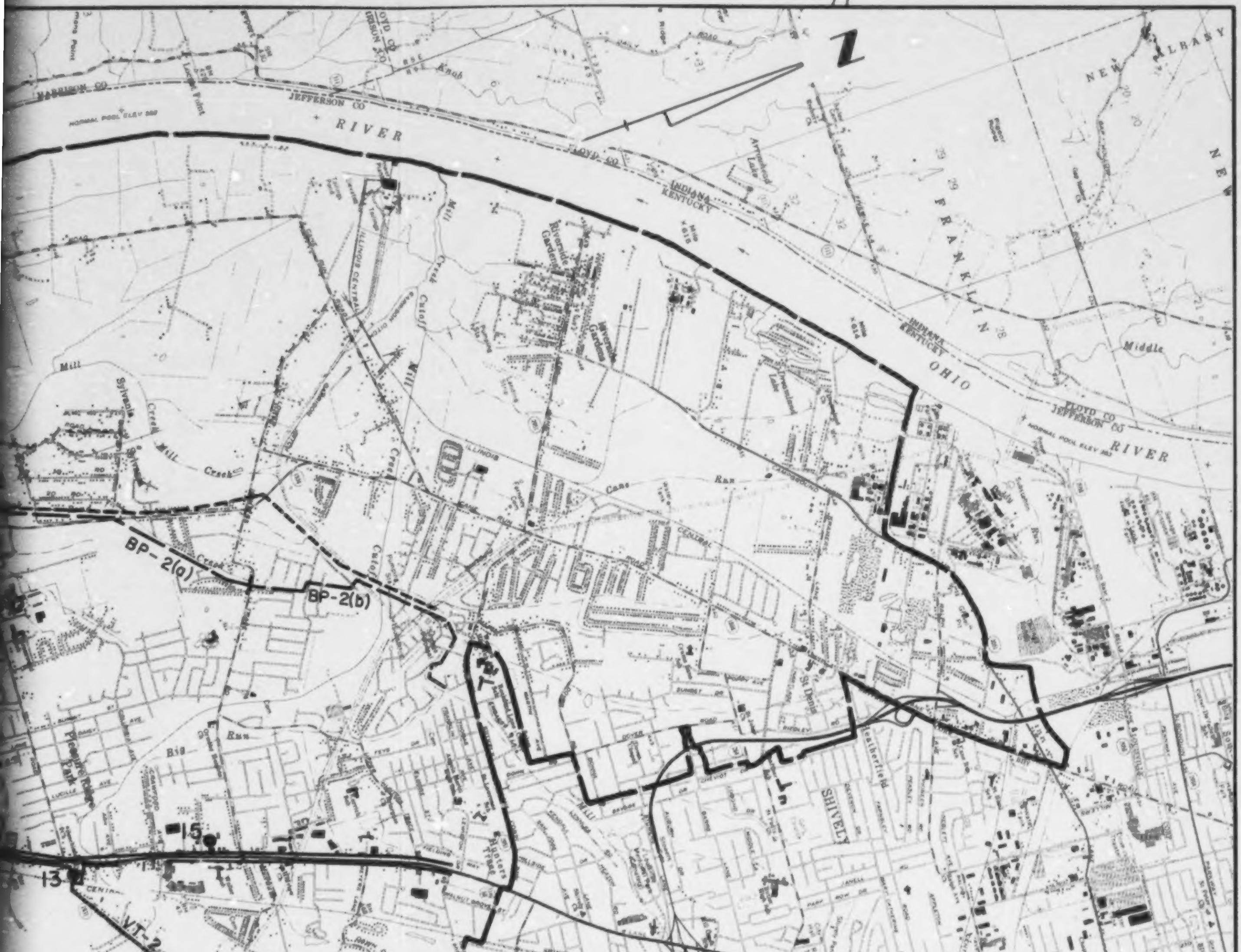

FIGURE 3

MILL CREEK
ENVIRONMENTAL IMPACT STATEMENT
JEFFERSON COUNTY, KENTUCKY

ALTERNATIVES
7A, 7B AND 7C

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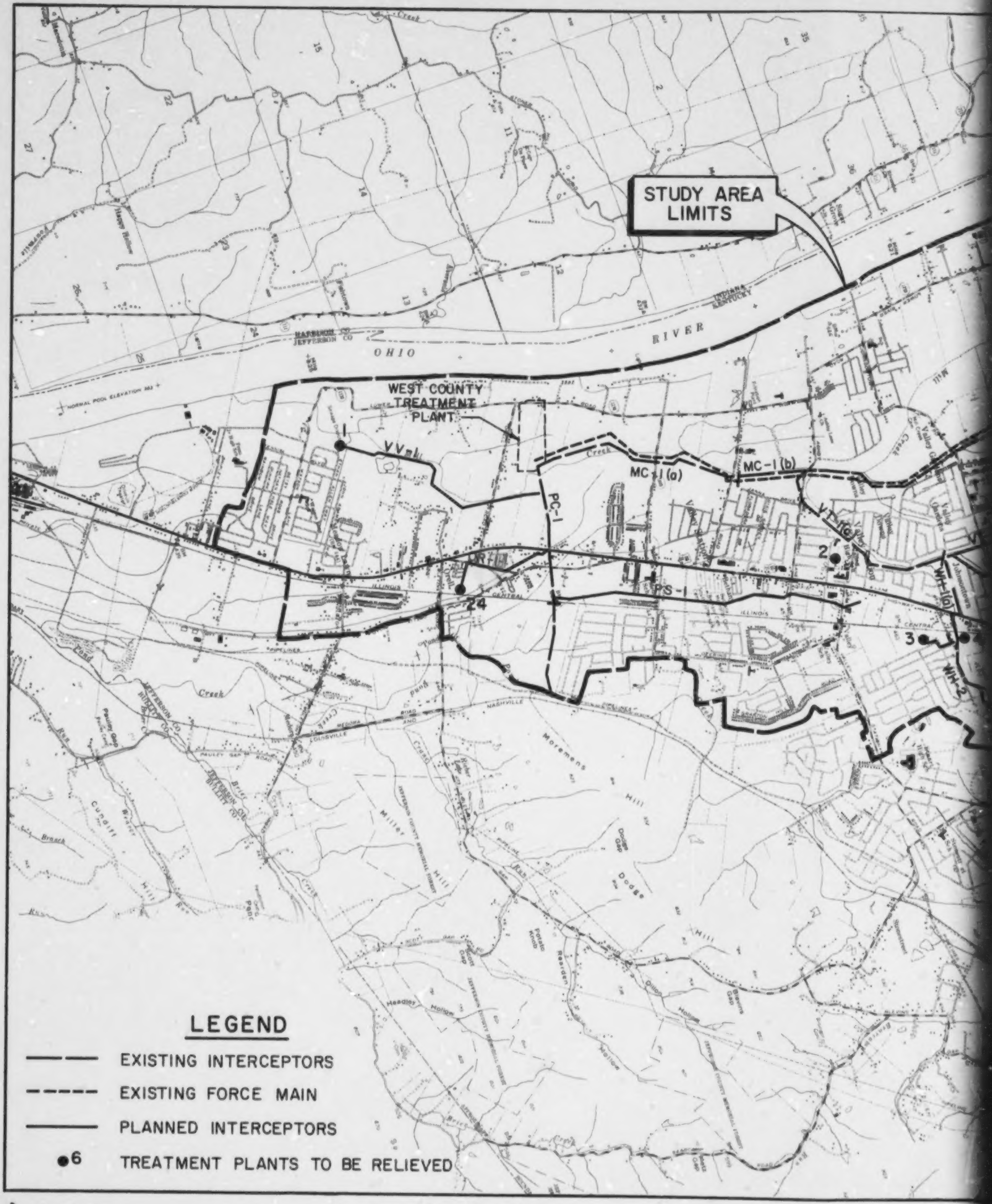
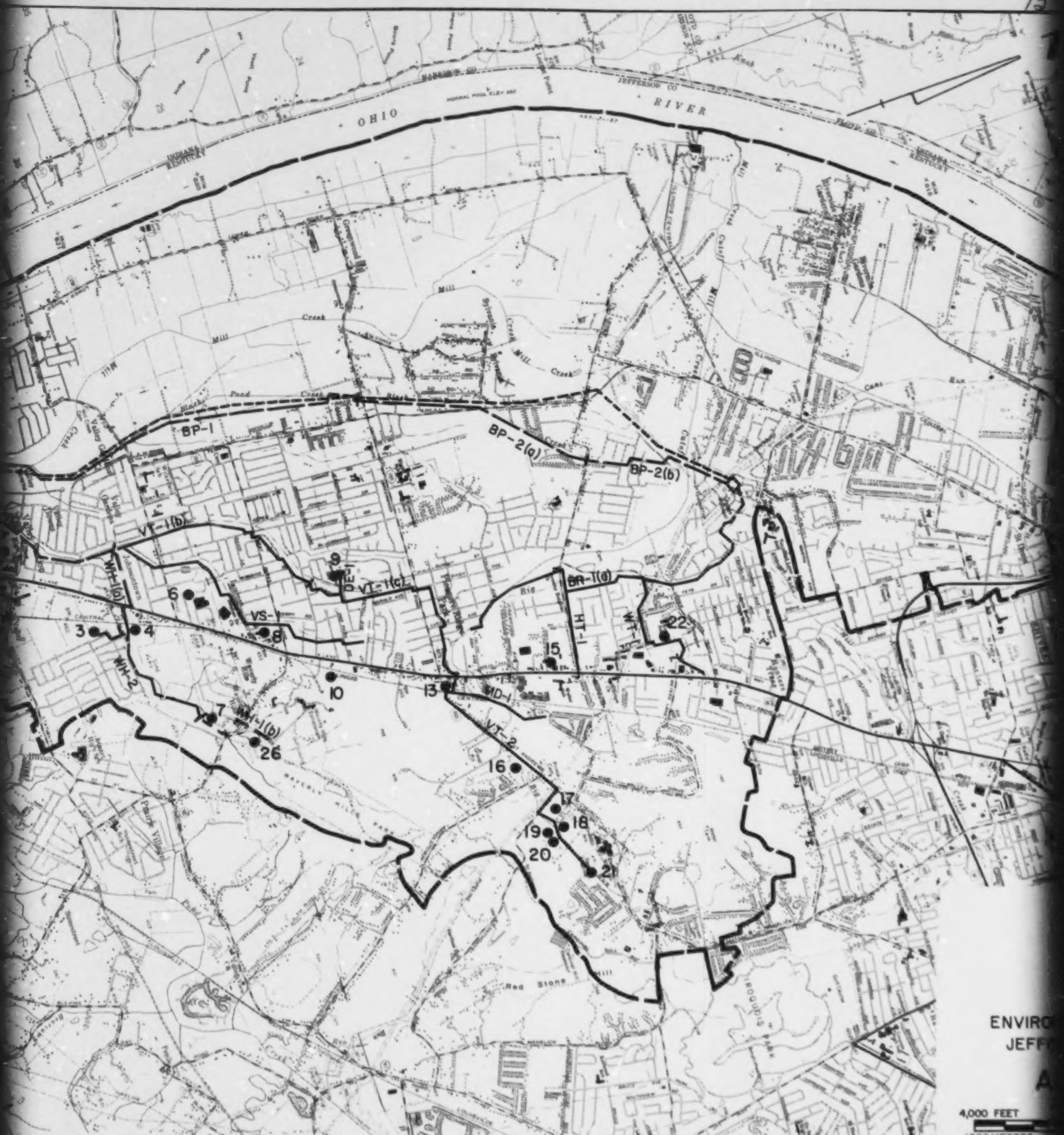

STUDY AREA LIMITS
WEST COUNTY TREATMENT PLANT
OHIO RIVER
INDIANA
KENTUCKY
HARRISON CO
JEFFERSON CO
NORMAL POOL ELEVATION 383
VV-1
PC-1
MC-1 (a)
MC-1 (b)
VT-1(a)
PS-1
WH-1(a)
WH-2
1
2
3
24
ILLINOIS
CENTRAL
NASHVILLE
LOUISVILLE
Pond Creek
Moremens Hill
Dodge Hill
Dodge Gap
Miller Hill
Potato Knob
Reardon
Headley Hollow
Cundiff Branch
Brier Hill
Pauley Gap
Johnsontown
Valley Gardens
LEGEND
EXISTING INTERCEPTORS
EXISTING FORCE MAIN
PLANNED INTERCEPTORS
●6 TREATMENT PLANTS TO BE RELIEVED

A

13



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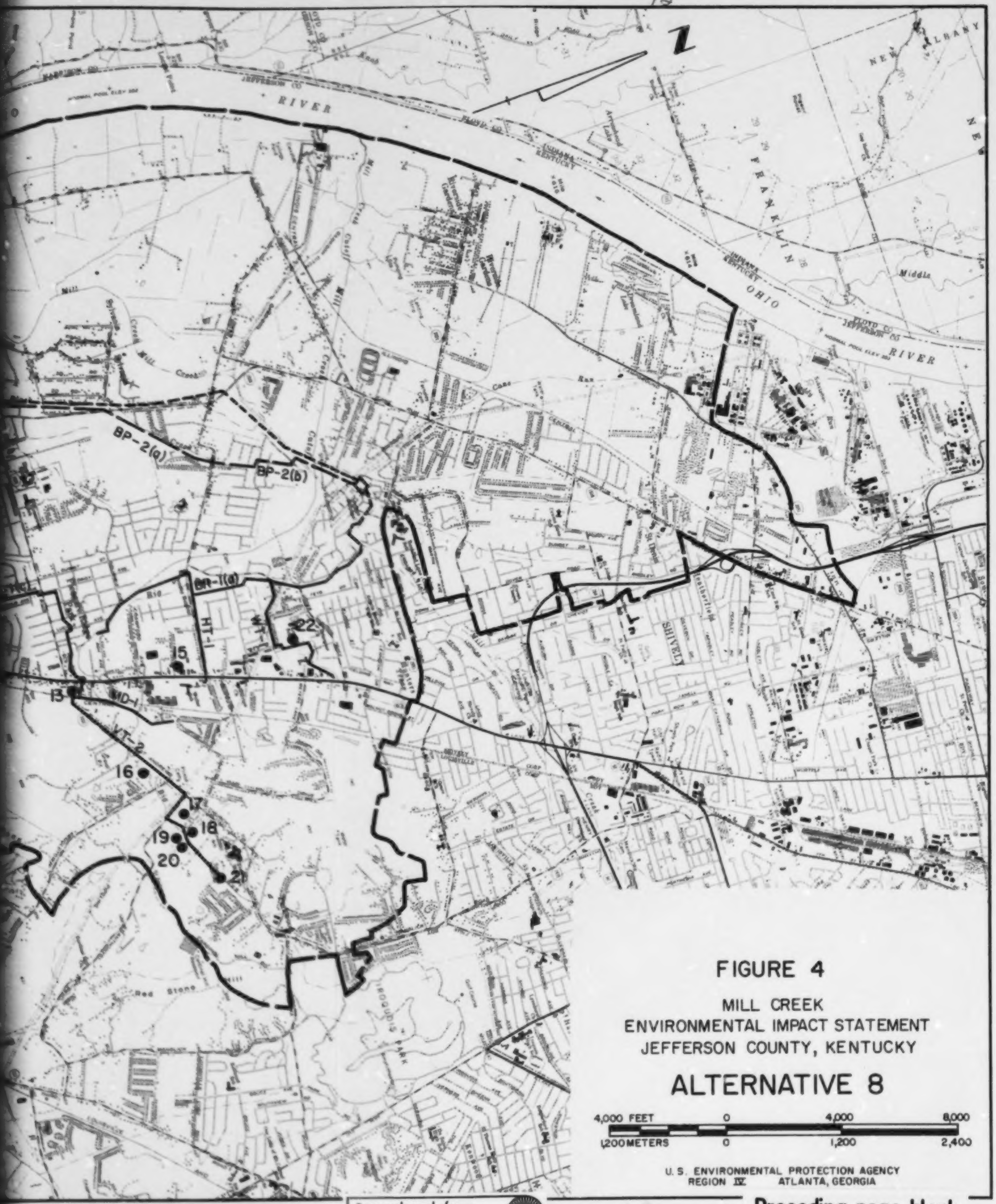

FIGURE 4

MILL CREEK
ENVIRONMENTAL IMPACT STATEMENT
JEFFERSON COUNTY, KENTUCKY

ALTERNATIVE 8

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV ATLANTA, GEORGIA

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TABLE 3. ALTERNATIVES EVALUATION SUMMARY

Alternative Number	Description of Alternative	Total Present Worth ($ Millions)	Advantages	Disadvantages
2a	Increased Septic Tanks & Existing Small WWTPs (Future development could connect to existing interceptor system)	27	1. Low Cost 2. Moderate to High Public Acceptance 3. Minor Construction Impacts 4. Relatively Easy Implementation	1. Continued Impact to Local Streams 2. Dixie Highway Corridor Not Relieved 3. Possible Land Use Effects Due to Health Dept. Regulations That Now Restrict Development on Septic Tanks to Lots Greater Than 5 acres 4. Possible Resistance by KY DNREP, Health Dept.,County, & MSD
2b	Increased Septic Tanks & Expanded Small WWTPs (Future development could connect to existing interceptor system)	31	1. Low Cost 2. Moderate to High Public Acceptance 3. Moderate Construction Impacts in Limited Areas	1. Increased Impact to Local Streams 2. Dixie Hwy. Corridor Not Relieved 3. Possible Land Use Effects Due to Health Dept. Regulations That Now Restrict Development on Septic Tanks to Lots Greater Than 5 acres 4. Possible Resistance by KY DNREP, Health Dept., County, & MSD 5. Moderate Adverse Public Health Impacts From Surface Water Discharges
6	Regional System	90	1. Removes Discharges From Local Streams 2. Dixie Hwy. Corridor Would Be Relieved 3. Allows Flexibility of Type and Density of Future Development 4. This Alternative is Favored by Local & State Agencies 5. Utilizes Interceptors Already Constructed	1. High Cost 2. Low Public Acceptance 3. Major Construction Impacts 4. Adverse Economic Impacts to Area Residents
7a	Limited Regional & Existing Septic Tanks & Increased Small WWTPs (Future development could connect to existing interceptor system)	50	1. Moderate Cost 2. Moderate to High Public Acceptance 3. Dixie Hwy. Corridor Would Be Relieved 4. Could Pick Up Most If Not All Small WWTPs 5. Minor Construction Impacts	1. Increased Impact to Local Streams 2. Possible Resistance by KY DNREP, Health Dept., County, & MSD 3. Moderate Adverse Public Health Impacts From Surface Water Discharges

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TABLE 3. ALTERNATIVES EVALUATION SUMMARY (CONT'D.)

Alternative Number	Description of Alternative	Total Present Worth ($ Millions)	Advantages	Disadvantages
7b	Limited Regional & Expanded Septic Tanks & Reduced Small WWTPs (Future development could connect to existing interceptor system)	32	1. Low Cost 2. Moderate to High Public Acceptance 3. Dixie Hwy. Corridor Would Be Relieved 4. Could Pick Up Most If Not All Small WWTPs 5. Minor Construction Impacts 6. Relatively Easy Implementation	1. Possible Resistance by KY DNREP, Health Dept., County, & MSD 2. Possible Land Use Effects Due to Health Dept. Regulations That Now Restrict Development on Septic Tanks to Lots Greater Than 5 Acres
7c	Limited Regional With Full Capacity & Existing Septic Tanks Until Hooked Up To Regional System	43*	1. Moderate Cost* 2. Low to Moderate Public Acceptance 3. Dixie Hwy. Corridor Would Be Relieved 4. Could Pick Up Most If Not All Small WWTPs 5. Relatively Easy Implementation 6. Allows Flexibility in Type & Density of Development	1. Possible Resistance by KY DNREP 2. Does Not Directly Address Long Term Solution of Wastewater Management 3. First Step in the Alternative with Highest Cost and Least Public Acceptance 4. Adverse Future Economic Impacts to Area Residents
8	First Phase 201 Regional System & Existing Septic Tanks Until Hooked Up To Regional System	45*	1-6. Same as 7c 7. Utilizes Interceptors Already Constructed	1-4. Same as 7c
9	No-Action (Future development could connect to existing interceptor system)	47	1. Moderate Cost 2. Moderate to High Public Acceptance 3. Minor Construction Impacts	1. Increased Impact to Local Streams 2. Questionable Reliability of WWTPs 3. Possible Resistance by KY DNREP, Health Dept., County, & MSD 4. Moderate Adverse Public Health Impacts

*Represents Phase 1 Cost Only. Ultimate Cost Would Be The Same As Alternative 6.

1.3.2 Public Acceptance

Public acceptance is expected to be closely related to the cost and inconvenience associated with an alternative, with public resistance increasing with cost or inconvenience. Groups other than homeowners have not been active in registering opinions concerning the alternatives. The probable reaction of specific groups affected by each alternative may be suggested by examining the particular interests or each group. Homeowners on seepage pits have expressed strong opposition to the financial and construction impact of a regional system. They have supported the maintenance of existing, properly functioning on-lot systems. Commercial owners will likely favor alternatives removing the responsibility of wastewater disposal from them, with cost a secondary consideration. Package plant owners will consider the alternatives in two ways. First, these owners will likely favor alternatives to upgrading. Second, this favoring will be tempered by an interest in compensation for abandoning their plant. Landowners with an interest in development will likely favor alternatives that most greatly facilitates the flexibility of development type.

1.3.3 Public Health

Public health can be impacted by changes in water quality, increases in pollution levels, or creation of high risk situations. In the Mill Creek area, impacts to public health relate primarily to ground and surface water quality, existing and future uses of these resources, and potential for human contact with these waters.

The quality of area groundwater, as determined by the EIS groundwater program, was found to be influenced by existing septic tanks (nitrates and bacteria) and not suitable as an untreated drinking water source. Some isolated samples showed high nitrate levels (above 10mg/l) and several showed elevated bacterial levels. Groundwater quality was found suitable, however, for development as a treated public water supply.

The potential for public health impacts related to groundwater influenced by septic tanks is tempered by the limited existing and future use of groundwater. Groundwater is now used by between 300-600 study area homes (1-2% of the study area) for private water supply. The cost of connecting each house not presently served by public water has been estimated by the Louisville Water Company to vary from less than $1,000 to $14,000 (Arbuckle 1980). The average cost is expected to be approximately $2,000 with a few isolated residences requiring the higher costs. These isolated residences would also be least likely to experience adverse effects from groundwater quality due to their being more remotely located from concentrations of groundwater discharges. A total of approximately $1.2 million would be required to connect all existing area residents to public water.

The EIS has determined that the current users of groundwater should be encouraged to hook up to a public water supply as soon as possible. The removal of septic tank discharges could not occur for several years even with a determined effort and therefore the potential for contamination and public health effects remains. The urban nature of the area and the prospect of additional industrial developments further diminishes the usefulness of the groundwater as an untreated drinking water source in the future.

The local surface streams are characterized by very low flow and run through densely populated residential neighborhoods. The primary function of the local surface streams is storm drainage. Secondarily, they are used as receiving streams for package plant discharges and for unsupervised recreation, including some body contact recreation. Because of the proximity of surface streams to residences, the potential for human contact is almost unlimited. The removal of discharges from surface streams would result in lower risk of bacterial contamination. It should be noted that under normal conditions discharges would receive disinfection and the risk would be low.

1.3.4 Water Quality

Water quality, both ground and surface, is currently affected by wastewater disposal practices. As with public health impacts, the use of the resource is critical when considering the significance of an impact on water quality.

An impact on groundwater quality is most significant when it adversely affects an existing or potential use. The effect on existing untreated drinking water use has been discussed under public health. With regard to future use, the Louisville Water Company has indicated that there are no short or long-term plans to use the groundwater in southwest Jefferson County as a public water source because of the urban nature of southwest Jefferson County. Therefore the potential for human contact with these groundwaters is limited. Nevertheless, existing data indicate that the groundwater of the Mill Creek aquifer could now and even in the future with increased wastewater discharges could then be used as a raw water source. With conventional disinfection, the finished drinking water would be expected to be well within established finished drinking water criteria.

Surface water quality is also important. The potential for bacterial contamination due to body contact recreation has been discussed under public health impacts. The other major water quality consideration is the meeting of water quality standards for dissolved oxygen, established to protect aquatic life. This requirement would result in the need for high levels of treatment and high costs for discharges to the small area streams. The lower level of treatment and costs for a regional system and discharge to the Ohio River must be compared with the costs of transporting these wastes to a central treatment plant and/or the river.

1.3.5. Financial Implementabilty

The impact of the EIS alternatives on MSD's ability to implement an overall wastewater management system and on MSD users was evaluated in the EIS Financial Impact Analysis (FIA). The FIA was prepared to address the specific concern that since the 201 Plan, as originally developed, was a viable on-going system that could be maintained and operated from customer revenues, a system that did not include the Mill Creek area residential base was of questionable viability.

Detailed cash flow projections were made for six scenarios involving four EIS alternatives: the regional alternative (#6), two limited action alternatives (#7B and 7C), and the no federal action alternative (#9).

In general, the FIA shows that the particular arrangement of projects within an expansion area appears to have little or no discernable impact on service charges to MSD customers. Additionally, developing public sewerage facilities of varying scope in the Mill Creek area does not have appreciable impact on MSD system service charges. Despite the broad differences in Mill Creek area activities for alternatives 6,7B,7C, and 9, the estimated annual MSD service charges are virtually the same.

Although bonding requirements vary somewhat among the scenarios, the total revenue needs do not differ markedly among the scenarios. It should be noted that through the planning period, each scenario involves essentially continuous construction activity at the level deemed reasonable by MSD. Thus, the impact on the MSD system of sewering or not sewering the Mill Creek area is imperceptible despite the relatively large capital cost associated with such construction.

1.4 Draft EIS Preferred Alternative

The previously discussed costs, public acceptance, public health, and water quality implications of the alternatives have been recognized as central elements in the decision making process. These evaluations lead to the conclusion that a regional system as proposed in the original 201 facility plan is not required at this time to solve the water quality and public health problems in the Mill Creek area. Alternative 7b has been selected as the most cost-effective, environmentally sound alternative.

The critical water quality problems in this area have been found to be caused by the discharge of inadequately treated wastewater by small package plants into local streams and the inability of on-site systems to adequately serve the commercial establishments along the Dixie Highway strip. Although the unsewered residential community does influence the quality of the groundwater, there does not appear to be significant deterioration of groundwater quality. Therefore, there is not a high priority need to sewer this portion of the community. The potential for public health impacts is tempered by limited existing use of the groundwater for private water supply and by the fact that the Louisville Water Company has indicated that because of hardness and iron, the urban nature of the area, and the influence of land use activities on water quality, no plans exist to use the Mill Creek aquifer as a future public water supply source.

In terms of cost, the present worth value of the regional sewer system (#6) is roughly $90 million as compared to about $27 million for a limited action system with expanded septic tank use and some connections to the existing interceptor system for future population (#7b). From the standpoint of the unsewered homeowner, the cost of the regional system translates to an initial assessment of at least $3,000 and a monthly bill of about $10. The cost to the homeowner for the limited action system would be similar to that which is now paid, very minimal. The recommended action involves a balance between the limited expenditure of large amounts of public and private funds and the limited impact of continued or future septic tank use on groundwater uses.

The critical issue in the EIS decision involves this evaluation of cost vs. desired future use of the Mill Creek aquifer. Although the Louisville Water Company has expressed no interest in developing the southwest aquifer for public water supply, the State and Federal governments have set goals of protecting groundwaters for public water supply wherever possible. The EIS Groundwater Program indicated that existing on-site systems are influencing groundwater quality and that the water is not suitable as an untreated drinking water source. With the application of conventional disinfection, however, these groundwaters would be suitable for consumption. Therefore, continued or increased use of septic tanks is not considered to be inconsistent with State and National goals of preserving groundwaters for public water supply use.

It is EPA's preliminary decision to pursue a course of action that involves correcting existing problems while taking no action on the on-site systems of the residential community because of limited demonstrated need. Alternative 7b has been tentatively selected (see Figure 3). This alternative proposes a limited sewering action that would service the Dixie Highway Corridor and at least eighteen of twenty-six small package plants, while leaving the residential community on septic tanks. The remaining eight small plants would be required to upgrade to meet water quality standards or construct a small force main to convey existing flows to the existing interceptor system.

Regarding the public health concern associated with groundwater quality, measures to mitigate a potential impact are available and are recommended to be considered locally. Because of the future questionable suitability of the aquifer as an untreated drinking water source, EPA encourages local agencies to extend public water service to those Mill Creek residences not now served.

In the cases where service cannot be extended, a groundwater quality monitoring program could include special emphasis on monitoring areas that would rely on groundwater for private water supply. Under any circumstance, private water supply users should be encouraged to disinfect area groundwater prior to consumption. Those residences for which public water connection costs are highest are likely to be the residences that are most remote from wastewater discharges. This factor minimizes the liklihood of a significant impact.

It should be noted that EPA supports the existing septic tank regulations and proposed regional system in the Pond Creek drainage area. The North Jefferson County study area is the subject of an ongoing EIS and decisions in North County will be made within the framework of that study. The Mill Creek Area Draft EIS preliminary decision should therefore be viewed as a decision that is specific to the Mill Creek EIS study area and the special circumstances of this area with no implications in other parts of Jefferson County.

1.5 Basis For the Decision

1. Existing groundwater quality is suitable for development as a treated drinking water source

2. Existing groundwater quality is generally not suitable as an untreated drinking water source

3. Residential on-lot systems in the Mill Creek area are functional and do not constitute a public health hazard through body contact

4. There are no plans to use the Mill Creek area groundwater as a public water source

5. Public water from the Louisville Water Company is available in close proximity to almost all Mill Creek area residents now drinking untreated groundwater

6. The construction impacts of 7b are significantly less than those associated with a regional system

7. A limited regional system (7b) provides service to the major wastewater management problem areas (Dixie Highway Corridor and small package plants)

8. The costs of 7b are significantly lower than those of a regional system:

	Regional System	7b	Difference
Capital Cost	$154 million	$50 million	$104 million
Present Worth	90 million	32 million	58 million

1.6 Riverport

The Riverport Industrial Park and Foreign Trade Zone is located along the Ohio River in the Mill Creek Area and occupies over 1,600 acres of river front land (see Figure 1). Riverport is currently developing the industrial park, and, only a small amount of non-industrial wastewater is now being generated.

With regard to wastewater management, there are three general alternatives for management of industrial wastewaters from the Riverport complex.

Wastewaters may be pretreated, if necessary, and:

1. collected and conveyed to the proposed MSD interceptor sewer system;
2. collected and treated at a central Riverport facility; or
3. handled and disposed of by each industry.

Since it is not yet known what type or how many industries will be developed at Riverport, the evaluation of Option 3 is not possible at this time.

The major differences between the remaining options are summarized below:

	Connect to MSD	Riverport Facility
Present Worth	$9,200,000	$13,000,000
Technical Feasibility	(1) Potential Exists for industrial wastes to upset MSD system (2) Industries shift NPDES responsibility to MSD	(1) NEPA Compliance may be required for each new source industry (2) Complex permitting could prolong development of Riverport.
Environmental Impact	(1) Riverport located on environmentally significant agricultural lands (2) Undeveloped lands proximal to Riverport that could be impacted by development are environmentally significant agricultural lands	

	Connect to MSD	Riverport Facility
Eligibility	Per 40 CFR 35.925-15, costs of interceptors constructed exclusively or almost exclusively to serve industrial users are not eligible for funding	

EPA's participation in funding facilities to serve Riverport are clearly determined by EPA regulations and policy.

40 CFR 35.925-15 states that facilities constructed exclusively or almost exclusively to serve industry are not eligible for EPA funding. The interceptor line that is proposed to serve Riverport is almost exclusively to be used to handle industrial flow from Riverport and is, therefore, not grant-eligible per EPA regulations.

EPA's Policy to Protect Environmentally Significant Agricultural Lands states that EPA should avoid actions that would cause or facilitate the irreversible conversion of significant agricultural land to uses which would result in its loss as an environmental or essential food production resource. In this regard, approximately 1,600 acres of environmentally significant agricultural lands are located within the boundaries of Riverport. An additional 500 acres lie east of Riverport between Mill Creek and Black Pond Creek. The proposed interceptor is not needed to serve existing residences or eliminate existing dischargers but primarily to serve future industrial users.

Based on EPA's regulations addressing the eligibility of facilities serving industry and EPA's Policy to Protect Environmentally Significant Agricultural Lands, it is proposed that EPA not support the extension of service to the Riverport Industrial Park through Federal construction grant funding.

2. PURPOSE OF AND NEED FOR ACTION

2.1 Purpose of the EIS

The Mill Creek Area EIS has involved a complete investigation of wastewater disposal alternatives in the planning area. The various wastewater management options were evaluated on several bases including:

1. The effect of alternatives on area homeowners;
2. The effect of alternatives on the natural environment;
3. The effect of alternatives on future residential, commercial, and industrial development in the study area; and
4. The problems associated with implementation of alternatives.

The Mill Creek Area EIS includes an investigation of existing and future groundwater quality and existing and potential uses of the groundwater resources to help determine the need for Federal funding of interceptor sewers in the Mill Creek Area. This issue is critical in areas where on-lot disposal systems are being used or where the potential for use exists.

The goal of the EIS has been to develop a rational evaluation of all alternatives for wastewater management in the study area.

2.2 Background and Issues

2.2.1 Study Area Setting

The Mill Creek Area EIS study area is located in Jefferson County (Figure 5), Kentucky's most populous county. It is located in the north central portion of the state, on the south bank of the Ohio River, approximately 1000 km (600 mi) below the head of the river at Pittsburgh. Jefferson County contains Louisville, Kentucky's largest city, and 53 other incorporated cities. Urban areas in the county serve as an important transportation, commercial and cultural link between the South and Midwest.

2.2.2 History of Wastewater Management

Sewers have existed in the Louisville-Jefferson County area for over 125 years. By 1946, when the Louisville and Jefferson County Metropolitan Sewer District (MSD) was organized, 900 km (560 mi) of sewer lines had been built in the vicinity of Louisville. Between 1946 and 1964 MSD constructed an additional 510 km (320 mi) of sewers. Most of the original sewers carried combined storm drainage and sanitary sewage for untreated discharge to the Ohio River. Efforts to abate pollution in the Ohio River stimulated the design and construction in 1956-1960 of the Fort Southworth Sewage Plant, later renamed the Morris Forman WWTP. Along with the construction of the treatment plant, the existing sewer system was modified to provide for the collection and delivery of all sanitary sewage to the treatment plant.

In 1964 all sewers within the Louisville city limits discharged wastewater to the Fort Southworth plant. Additionally, the plant received wastewater from several sewered areas beyond the Louisville corporate boundaries. In 1964 MSD also operated several small wastewater treatment plants (WWTPs) in Jefferson County.

Wastewater treatment in areas not served by MSD has been accomplished traditionally by individual on-lot disposal systems. Certain incorporated areas and subdivisions in Jefferson County not served by MSD are served by independent systems of sewers and small treatment plants.

Because of the unavailability of a centralized wastewater management system in the Mill Creek area, wastewater management needs have been met by utilizing on-lot disposal systems and small-area wastewater treatment plants. The on-site needs for waste disposal could have presented a problem to the development of the study area had it not been for the structure by the most recent alluviation of the Ohio River which presented an obstacle to the application of traditional technology associated with on-lot disposal of human waste, the septic tank and lateral field. This problem was initially overcome by builders adopting a method of waste disposal that discharged wastewater into the sand and gravel located below the relatively impervious clay and silt zone. This method, which combined the use of septic tanks and seepage pits, has been supplemented more recently by small-area wastewater treatment plants. These plants discharge their wastewater into the channelized and concrete-lined streams of the study area.

The 1964 Master Plan

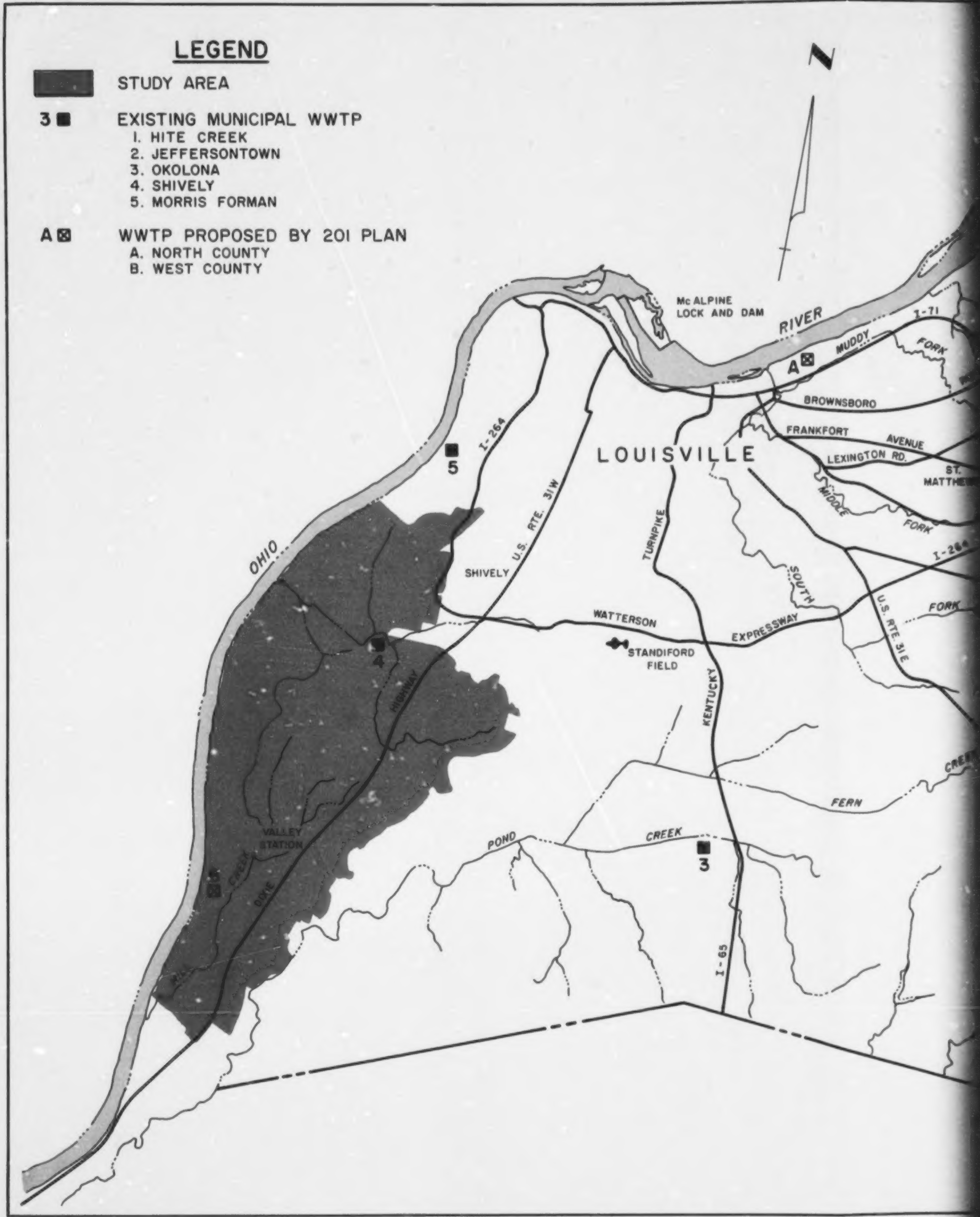
The first master plan for the development of a sanitary sewerage system for areas of Jefferson County outside of Louisville and Shively was prepared in 1964. This plan proposed the elimination of septic tanks and other individual treatment plants through sewer construction in developed areas, and the construction of two major treatment plants and several small treatment plants. The construction program was divided into four phases:

Phase I. 1965-1970: Reorganization of MSD; acquisition of all existing sewerage facilities in the county; construction of trunk sewers in Middle Fork and South Fork, and other small trunk sewers; and construction of temporary treatment plants where required.

Phase II. 1970-1975: Construction of interceptor sewers and first stage of permanent treatment plants.

Phase III. 1975-1980: Extensions of trunk sewers and treatment plants as required.

Phase IV. Completion of proposed program.


LEGEND
STUDY AREA
3 ■ EXISTING MUNICIPAL WWTP
1. HITE CREEK
2. JEFFERSONTOWN
3. OKOLONA
4. SHIVELY
5. MORRIS FORMAN
A ⊠ WWTP PROPOSED BY 201 PLAN
A. NORTH COUNTY
B. WEST COUNTY
N
McALPINE LOCK AND DAM
RIVER
OHIO
A
MUDDY
FORK
I-71
BROWNSBORO
FRANKFORT
AVENUE
LEXINGTON RD.
ST. MATTHEWS
LOUISVILLE
MIDDLE
FORK
I-264
5
I-264
U.S. RTE. 31W
SHIVELY
TURNPIKE
SOUTH
FORK
U.S. RTE 31E
WATTERSON
EXPRESSWAY
STANDIFORD FIELD
4
HIGHWAY
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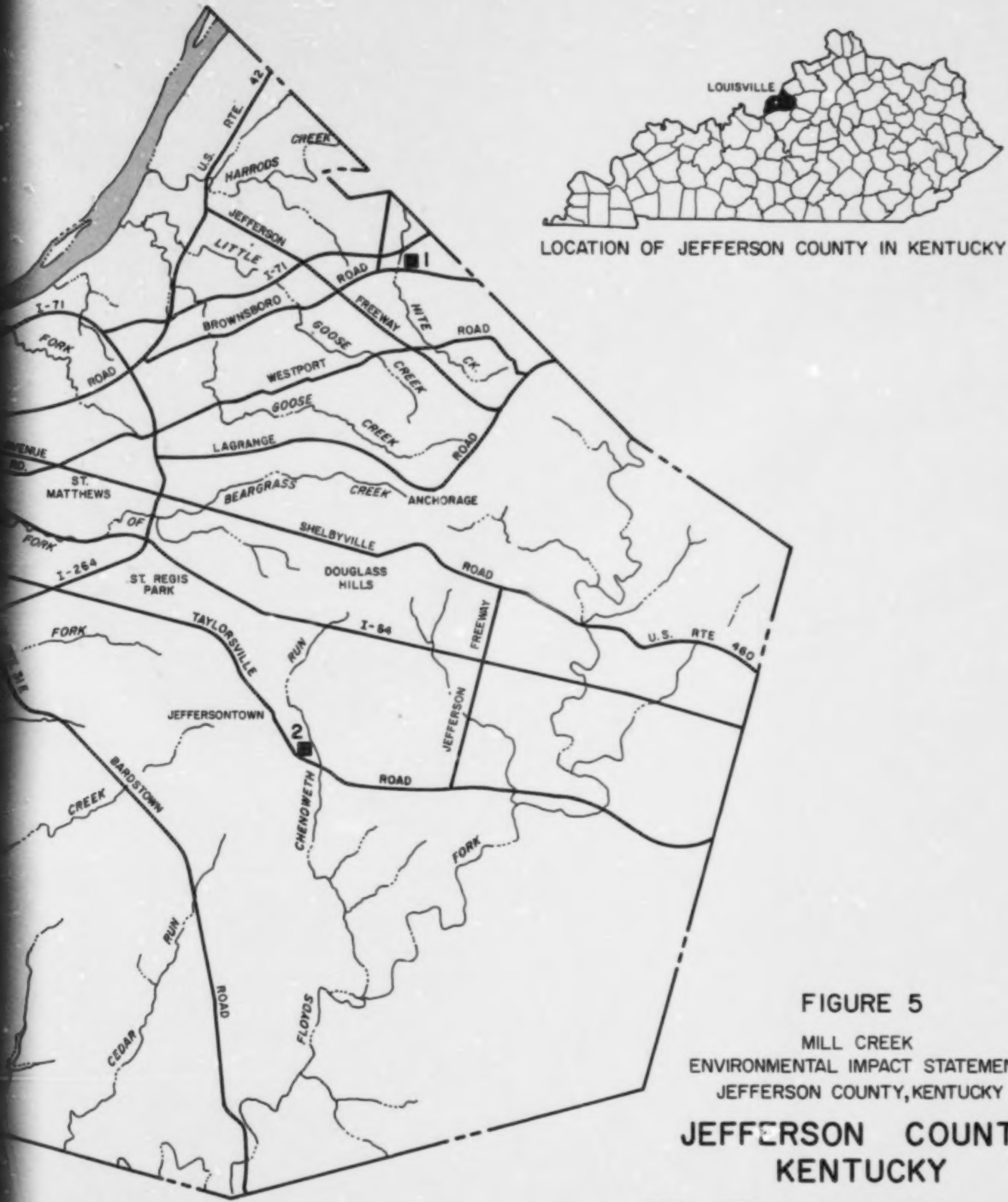

LOCATION OF JEFFERSON COUNTY IN KENTUCKY

FIGURE 5

MILL CREEK
ENVIRONMENTAL IMPACT STATEMENT
JEFFERSON COUNTY, KENTUCKY

JEFFERSON COUNTY
KENTUCKY

12,500	FEET	0	12,500	25,000
3,800	METERS	0	3,800	7,600

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REGION IV ATLANTA, GEORGIA

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The total cost of acquisition and construction for the program was estimated at approximately $118 million.

Conclusions resulting from this study included:

1. Septic tanks should be considered as only a temporary method of sanitary sewage disposal except in rural areas.
2. Satisfactory execution of the master plan requires the control of all storm and sanitary sewers and treatment plants under one central agency, such as MSD.
3. Local sewers constructed after an area is built up are much more expensive (50 to 100% more) than local sewers constructed with the development.
4. A definite policy appears necessary that will assure all developers and homeowners of a fair and reasonable set of requirements and charges.
5. System testing and control of infiltration must be rigidly enforced to prevent overloading of sewers.
6. A service scheme considered most efficient was defined for the study area (see Table 4).
7. Financing the master plan was discussed and considered economically feasible at rates and charges comparable to present charges in the area.

Recommendations of the report included:

1. Create a separate County Division of MSD with authority to acquire all existing sewerage systems outside the Louisville and Shively city limits.
2. Require sanitary sewers for all future developments.
3. Implement the 1964 Master Plan with periodic review and updating.
4. Authorize a financing study by fiscal consultants.
5. Provide MSD with the authority to own, construct, maintain and operate all sewerage systems, to fix rates for customers and to establish connection charges to developers.

2.2.3 Legislative/Regulatory Foundation

This segment of the report presents a tabular summary (Table 5) of the legalities involved in the construction of wastewater treatment facilities and the installation of sewage disposal systems in the Commonwealth of Kentucky.

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Table 4 1964 MASTER PLAN SERVICE SCHEME

Service Area	Served by . . .
North County	Single collection system; Treatment at a major treatment plant on the Ohio River and a small plant on Hite Creek.
Middle Fork	Louisville MSD system.
South Fork	Louisville MSD system and Pond Creek sewers.
Pond Creek	West County Treatment Plant.
Mill Creek	West County Treatment Plant.
Paddy Run & Southwestern Outfall	Louisville MSD system.
Floyds Fork	Short branch sewers with temporary treatment plants.

2.2.4 The 201 Water Quality Management Plan

In 1973 the Kentuckiana Regional Planning and Development Agency (KIPDA) initiated the preparation of a facility plan under Section 201 of PL 92-500. The 201 Plan generally recommended implementation of the 1964 Master Plan. For the Mill Creek area, wastewater would be treated at a new West County WWTP with effluent discharged to the Ohio River and sludge conveyed to Morris Forman for dewatering and incineration. Recommendations of the 201 Plan for the Mill Creek area are illustrated in Figure 1. Two significant recommendations of the 201 Plan were the abandonment of virtually all small wastewater treatment plants and the elimination of on-lot wastewater disposal systems in heavily settled areas.

In May 1975, following review of the 201 Plan by the Kentucky Department for Natural Resources and Environmental Protection (KDNREP) and EPA, it was determined that the Kentucky portion of the Water Quality Management Plan was substantially complete. An Environmental Impact Appraisal was prepared by EPA documenting the decision that an EIS was not required. This determination allowed EPA Region IV to commit federal construction grant funds to several design and construction projects in Jefferson County.

Kentucky Legislative Action

Due to considerations of the financial impact of the proposed sewer expansion program, the 1976 Kentucky General Assembly created an Interim Special Committee on Jefferson County Sewage Disposal Needs to develop recommendations for the 1976 Extraordinary Session of the General Assembly. Resolutions were adopted calling for a study of alternative methods of sewage disposal; a study of the responsibility, financing, planning and implementation of a comprehensive sewer project for the county; a thorough analysis of sewer legislation; and public hearings on sewer-related problems to be held by the Public Service Commission. These resolutions provided for a focusing of attention on the environmental and economic impacts that might result from a comprehensive sewer project for the county.

TABLE 5 LEGISLATIVE/REGULATORY SUMMARY

Legislation/Regulation	
(a) KRS94	Authority to establish, operate and maintain sewerage systems
KRS107	Municipal improvements including: wastewater treatment systems; Kentucky Wastewater Revolving Fund; Sewer Assessment Hardship Fund
KRS224:220 to 224:237	Septic tank servicing: licensing; vehicle tank requirements; disposal of wastes
KRS318:30 and 318:31	On-site sewage disposal systems: plumbing installation permits; alternative on-site systems
State Plumbing Code Regulation 20 20:130 to 20:180	Sewage systems: materials; methods of installation; tests and inspections; commercial septic systems
Board of Health Sanitary Code Ch. 3 Sec. 303.5 to 303.8	Wastewater treatment facilities: industrial facilities classifications; regulation fee schedule; operation standards; owner and operator responsibilities; effluent standards
Ch. 4 Sec. 304:401 to 304:407	Individual or home sewage disposal systems; lot characteristics; allowable wastes; house sewer standards; grease trap requirement; septic tank standards; subsoil absorption system standards; privies

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(a) KRS--Kentucky Resolved Statute

MSD's position was presented to the Special Committee by Mr. Jack Wilburn, and called for legislation regarding assessment practices and legislation to allow MSD to directly enforce hook-up requirements.

The committee also heard from Mr. Ed Butler, owner of a private wastewater treatment plant, concerning the issues involved in acquisition of private wastewater disposal systems by MSD. He felt the developers had made a contribution to the community's ability to continue to grow despite the lack of MSD facilities, and the owners of these facilities should be compensated for their sewerage systems. Mr. Butler said he felt that there were ways to provide sewer service to the county at costs less than those cited in the 201 Plan, and that owners of treatment plants that provided adequate treatment should not have to abandon those facilities.

After months of deliberation The Interim Special Committee on Jefferson County Sewage Disposal Needs developed recommendations that were presented at the 1976 Extraordinary Session as Senate Bill 12. Following amendment, the bill was signed by the Governor on December 12, 1976, and contained the following concepts:

1. Authorize MSD to float benefit assessment bonds against the benefitted property. This provision would allow MSD to tap the national bond market to obtain adequate financing at the most desirable rate of interest.

2. Provide for public hearings as an essential part of every phase of the county-wide project.

3. Allow property owners the alternative of paying for the sewer assessments over a long term or in a lump sum payment.

4. Establish a revolving fund to provide for the deferred payment of benefit assessments on agricultural and undeveloped land, and to provide that only one benefit assessment be made against such property for each residence of said property, the remainder to be paid from a revolving fund. The owner would repay assessments paid from the revolving fund at the time the property is developed.

5. Increase representation on the MSD board so that the Mayor would appoint four members and the County Judge would appoint three members.

6. Prohibit an assessment for collector lines against a piece of property if that property has been previously sewered.

7. Require MSD rather than the Louisville Water Company to pay for the repair and replacement of water mains disturbed during the construction of the project.

8. Establish that bonding attorney fees shall be reviewed and approved by the Board of Aldermen or Fiscal Court.

9. Require that both Fiscal Court and the Board of Aldermen shall approve sewer service rate changes.

10. Strengthen penalties for corrupt practices in connection with a sanitary sewer project.

Controversial Issues

Following EPA review and approval of the Louisville 201 Plan, several points of controversy became evident. The issue of MSD acquisition of private small WWTPs ultimately became a topic for litigation.

A proposal for NPDES permitting strategy for small WWTPs was prepared in early 1975, with requirements based on anticipated dates of connection to the MSD system. Effluent limitations were drafted after the completion, in late 1975, of a wasteload allocation study. In October of 1975, EPA prepared draft permits for these plants and sent them out for comment. These draft permits gave the permittees the alternatives of compliance with the wasteload allocation effluent limitations by July 1, 1979, or the submission by July 1, 1977, of a commitment to connect to the MSD system when it became available to the plant. Under the second alternative the permittees were to meet secondary treatment standards through the term of the permit or until connected, whichever occurred first.

EPA published its Notice of Proposed Issuance of discharge permits on November 7, 1975. A public hearing was required and was convened on February 5, 1976. Comments at this hearing basically fell into two categories:

1. Permittees objected to the stringency of the limits and abandonment of their facilities, presumably without compensation; and

2. Citizens and environmental groups objected to potential discharges in violation of water quality standards.

Based on these comments, it was determined that substantial modifications of the proposed permits were necessary and notice of this determination was published May 12, 1976. The permits issued differed from those proposed in that the commitment to connect was limited to connection within the term of the permit being issued. If connection was not anticipated prior to the 1981 expiration date, then compliance with the wasteload allocation effluent limitations had to be achieved by July 1, 1979.

A legal action filed in Jefferson Circuit Court by the owner of the Douglas Hills WWTP raised the issues of the claim of the permittee for compensation, and the authority of the State to enforce its certification requirement under state law. The judge in this case issued an order ruling that the facility involved could not be forced to connect to MSD in the absence of just compensation. This decision was upheld by the State Court of Appeals. In 1979, the State Supreme Court affirmed, in part, and reversed, in part, the State Court of Appeals decision by stating that "It is our opinion that so long as the Sanitation Company's disposal plant is operated in conformity with applicable orders and regulations of the various governmental agencies, including the Board of Health, having regulatory authority in the premises, and in a manner that is not inconsistent with public health and safety, MSD cannot force the collection system to be diverted to MSD's system without payment of the value of the disposal plant to its owner, the Sanitation Company."

In March of 1977 the Southwest Jefferson County Homeowners Association forwarded a letter to the President's Council on Environmental Quality (CEQ) and the U.S. Attorney General, with a copy to EPA, requesting a complete EIS on the 201 Study. The basis for the Homeowners Association's request centered upon a number of concerns that were expressed in a February 1978 letter from the President of the Homeowners Association to EPA's Regional Administrator.

Concurrent with these requests from the Homeowners Association, MSD was proceeding with several 201 Plan design and construction projects already approved and funded.

2.3 EPA Actions Related to the EIS

In response to citizen's concerns and a review of issues in the 201 Plan, EPA issued a Notice of Intent to prepare an EIS on certain lines in the West County area in September 1977. Subsequent to this notice, MSD expressed concern that the EIS process could interfere with current and future 201 Plan projects. MSD requested that the EIS be expanded to include the entire Jefferson County 201 Plan or, to avoid future disruptions, that EPA give written assurance that an EIS would not be required on any other parts of the 201 Plan. MSD decided not to commit or spend more local funds on the 201 Plan until the EIS is completed, and instructed its counsel to seek legal remedies to negate the delays and cost caused by the EIS. EPA assured MSD that the EIS would not affect projects for which bids had already been received, but could not fill the request for an assurance of no future EIS studies in the 201 Plan area.

In November of 1977 EPA agreed to examine MSD's request to expand the West County-Mill Creek EIS to cover the entire Jefferson County portion of the Water Quality Management Plan. To ensure that the public was aware of the discussions relative to scope and coverage of the EIS, EPA scheduled a public meeting for January 26, 1978. This meeting was to also serve the purpose of receiving input from the public and local agencies for consideration in defining the proper scope of the EIS. This public meeting was postponed as a result of inclement weather and was rescheduled for February 21, 1978. In the interim the Homeowner's Association filed Suit in the U.S. District Court to enjoin EPA and MSD from proceeding with implementation of the 201 Plan.

Additionally, the Homeowners Association requested that a "full comprehensive Environmental Impact Statement be prepared for the Riverport industrial park, the West County Wastewater Treatment Plant, and connecting interceptors that are in the process of being constructed in Southwest Jefferson County, Kentucky."

After consideration of the comments received at the February 1978 public meeting and other related concerns, EPA determined that the West County-Pond Creek System was cost-effective and environmentally sound and that a Negative Declaration was warranted. This Negative Declaration was issued on May 17, 1978.

EPA further resolved that significant controversy and unresolved issues surrounded the 201 Plan recommendations for the Mill Creek Basin portion of the West County area and a Notice of Intent to prepare an EIS on this portion of the 201 study area was issued on May 17, 1978. At issue in the Mill Creek Basin is the need for EPA to provide Federal funds for sewer service to residential areas currently served by individual on-lot disposal systems and the provision of sewer service to the Louisville-Jefferson County Riverport Industrial Park. The Mill Creek EIS study area limits are shown in Figure 1.

3. ALTERNATIVES DEVELOPMENT AND EVALUATION

3.1 Introduction

The development of alternatives is the activity in the EIS process by which a reasonable set of options for wastewater management are described in detail. The reasonable alternatives are then subjected to an evaluation process in which each option is analyzed for cost-effectiveness, environmental and financial impacts, and practicality. Evaluation of the environmental impacts of the various alternatives will be carried out by weighing projected effects against the quality of the existing environment in the study area.

The alternatives development process for the Mill Creek EIS was initiated by a public workshop held at the Pleasure Ridge Park High School on July 24, 1979. The workshop was used as a forum for providing the public with descriptions of the full range of alternatives for collection, treatment, and disposal of wastewater. Public input, in the form of discussions of described alternatives and suggestions of additional alternatives, was solicited and received.

The complete set of collection, treatment, and disposal options was arranged to form a set of wastewater management system alternatives for further consideration. This lengthy list was submitted to a preliminary screening process, during which many system alternatives were rejected from further description and evaluation. The screened list, comprised of the reasonable alternatives for the Mill Creek study area was presented to the public in a second alternatives development workshop on November 13, 1979.

The collection, treatment, and disposal components for wastewater management systems, as developed at the first Alternatives Development Workshop, are presented on Table 6. The physical features of the components, as well as some possible limitations, were described in the Mill Creek EIS Wastewater Alternatives Development Handbook, which was distributed at the workshop. The three collection components, nine treatment components, and five disposal components may be arranged to yield 78 alternative systems; on-site-system alternatives are illustrated in Figure 6 and central-system alternatives in Figure 7.

The Mill Creek study area was divided into 58 subareas that generally encompass one or more service areas as designated in the sewer-service planning of the Louisville and Jefferson County Metropolitan Sewer District. Delineation of subareas was carried out to facilitate the development and evaluation of alternatives. Subareas should not be construed as individual planning units, but rather as subunits of a planning area that includes the entire Mill Creek study area. This distinction is quite important. Wastewater management system alternatives were not evaluated on a subarea-by-subarea basis, but rather on a study area basis to facilitate the evaluation of alternatives. Further, the subareas were not developed as planning units in which environmental impacts of each alternative would be assessed.

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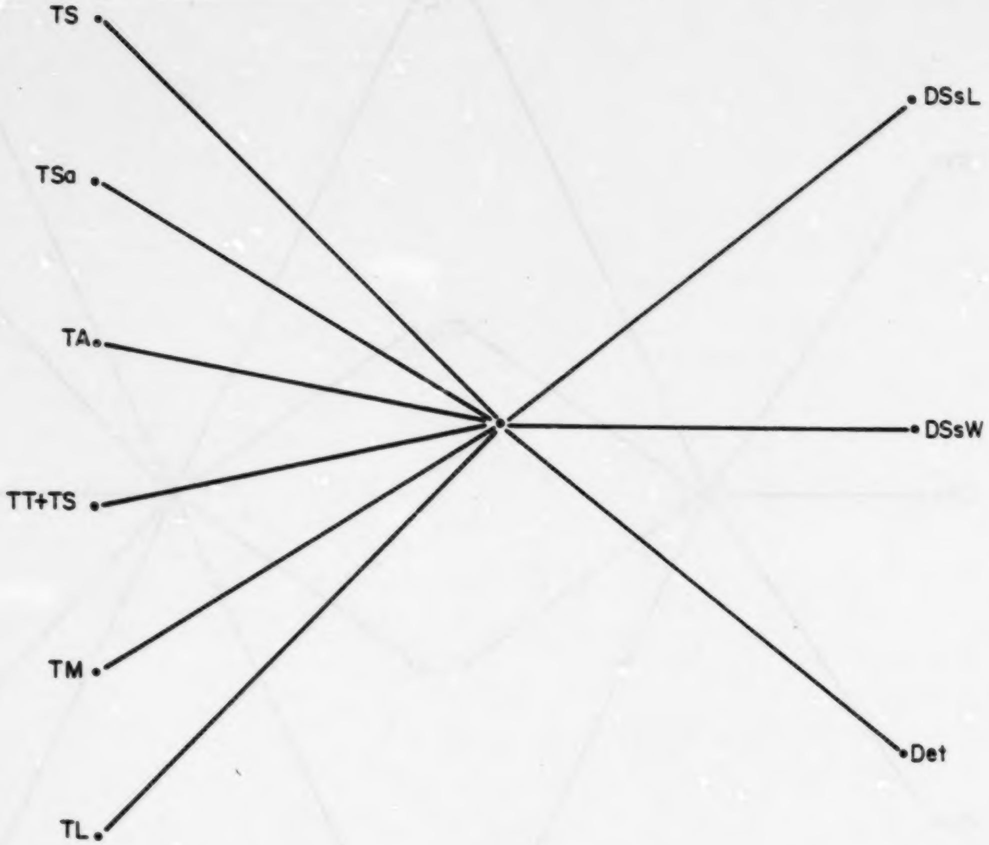
TABLE 6. COMPONENTS AND CODES FOR WASTEWATER MANAGEMENT ALTERNATIVES

	Description	Code
I.	Collection components	C
	Gravity sewers	CG
	Pressure sewers	CP
	Vacuum sewers	CV
II.	Treatment components	T
	Septic tanks	TS
	Septic tank + additional units	TSa
	Individual aerobic units	TA
	Alternative toilets	TT
	Individual methane generation units	TM
	Wastewater lagoons	TL
	"Conventional treatment"	TC
	Primary treatment plant	TCp
	Secondary treatment plant	TCs
	Advanced wastewater treatment plant	TCa
III.	Disposal components	D
	Surface water discharge	DSu
	Subsurface discharge	DSs
	Leaching fields	DSsL
	Disposal wells (seepage pits)	DSsW
	Land application	DL
	Other	
	Evapotranspiration beds	Det

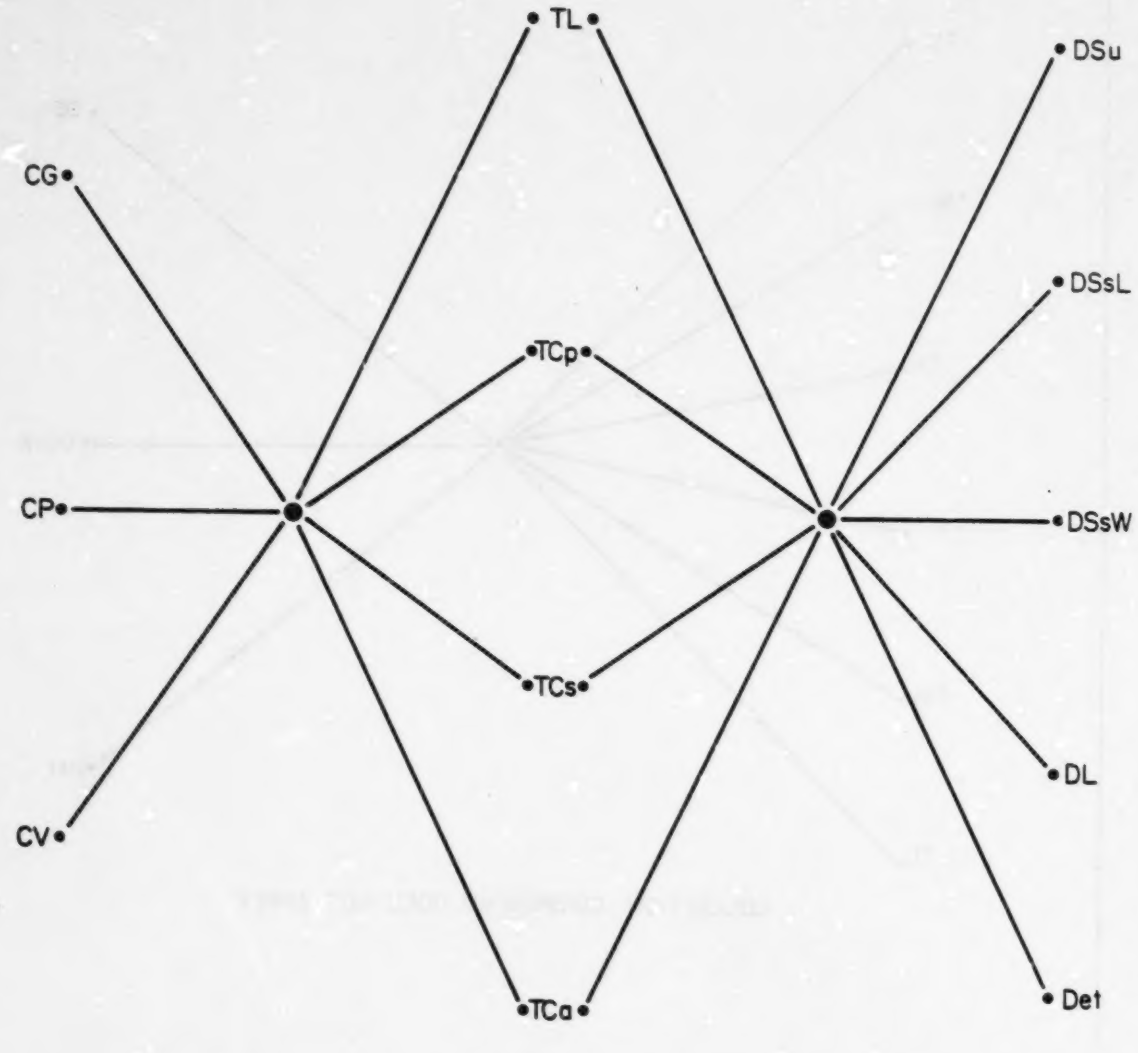


COLLECTION COMPONENT DOES NOT APPLY

NOTE : NON - TOILET WASTEWATER (GRAYWATER) WOULD HAVE TO BE DISPOSED TO A SEPTIC TANK SYSTEM.

ALTERNATIVE
ON-SITE WASTEWATER
MANAGEMENT SYSTEMS

FIGURE 6



ALTERNATIVE
SEWERED WASTEWATER
MANAGEMENT SYSTEMS

FIGURE

Generally, management system alternatives were studied for the entire study area, with subareas serving as a convenient unit for determination of physical facilities and costs. In certain cases, individual subareas were given special consideration with respect to the feasibility of specific alternatives. These special cases will be noted as they occur. The 58 subareas and the areas which are presently served by sewers and small wastewater treatment plants (WWTPs) are shown in Figure 8.

3.2 Wastewater Conveyance and Treatment Systems

3.2.1 On-Site Alternatives

A total of 18 on-site wastewater management system alternatives are shown in Figure 6. Six of the alternatives involve disposal of treatment unit effluent to evapotranspiration (ET) beds. ET beds preclude wastewater percolation into the soil, relying on evaporation and transpiration to remove wastewater from the bed. Obviously, ET beds will operate successfully only in areas where average annual evapotranspiration exceeds average annual precipitation by an amount sufficient to provide for discharge of wastewater to the atmosphere. According to data presented in EPA's Process Design Manual for Land Treatment of Municipal Wastewater (EPA 625/1-77-008), average annual precipitation in the Louisville area exceeds average annual evapotranspiration by about 25 cm (10 in.). Clearly, all alternatives involving disposal of effluent to ET beds must be rejected.

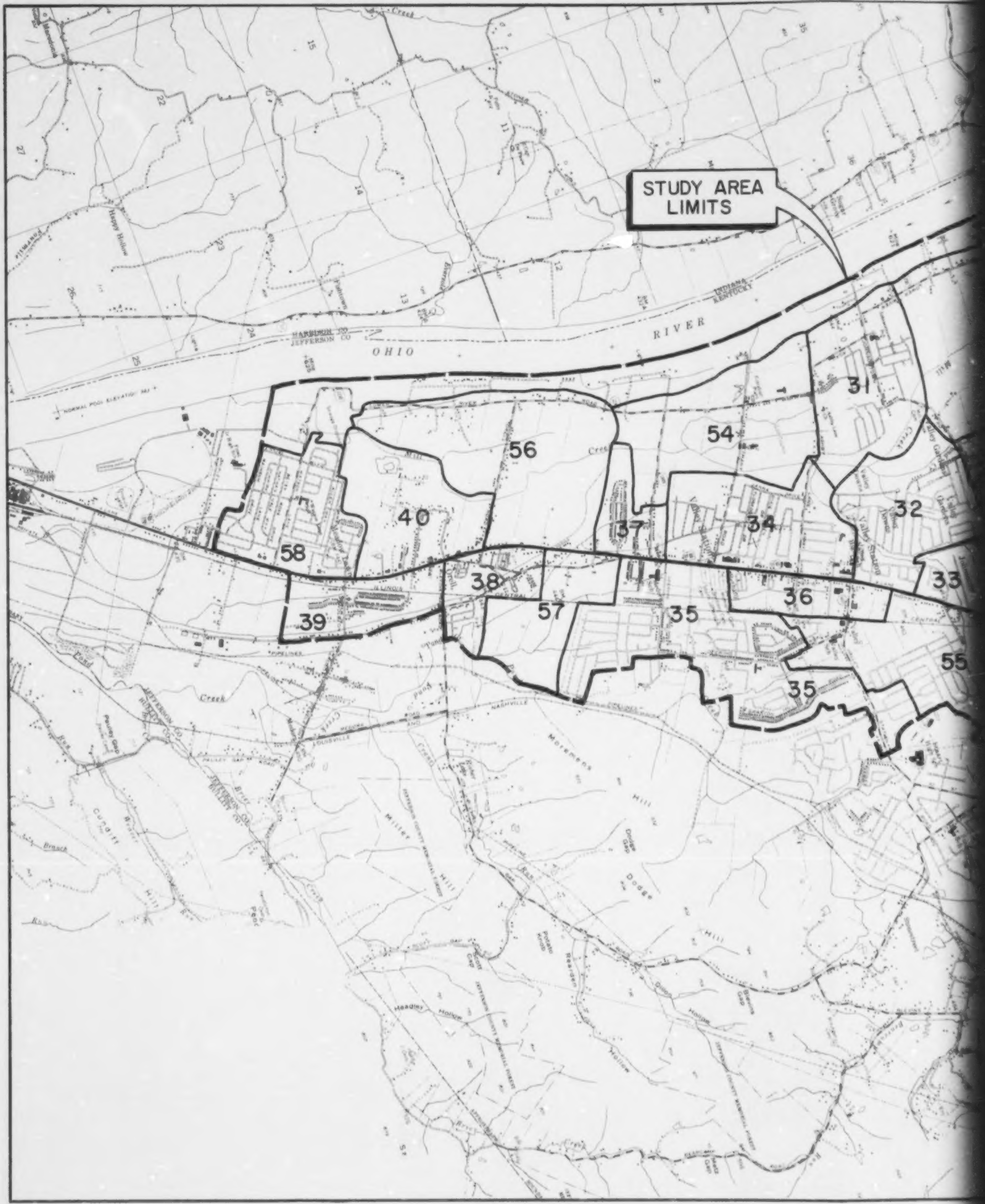
Of the remaining 12 on-site system alternatives, all but one involve the ultimate discharge of all household wastes to subsurface disposal units. The alternative toilet and septic tank (TT + TS) alternative removes toilet waste from the disposal system by use of alternative toilets (Figure 9), such as composting, incinerating, or chemical units. Household graywaters, such as sink and bathtub wastewaters would be handled by treatment in septic tanks and discharge to subsurface disposal units under the TT & TS alternative. The alternative toilet will remove nearly all nitrogenous wastes from the subsurface disposal unit. Each of the remaining eleven systems would have essentially the same impact on groundwater, with respect to nitrate. Of the eleven systems which involve discharge of toilet wastes to subsurface disposal units, the septic tank and seepage pit (TS-DSsW) system is the most logical alternative for detailed analysis. The septic tank and seepage pit is the predominant disposal method in use in the study area.

The screening process reduced the 18 general on-site alternatives to a list of 2 reasonable alternatives for detailed analysis:

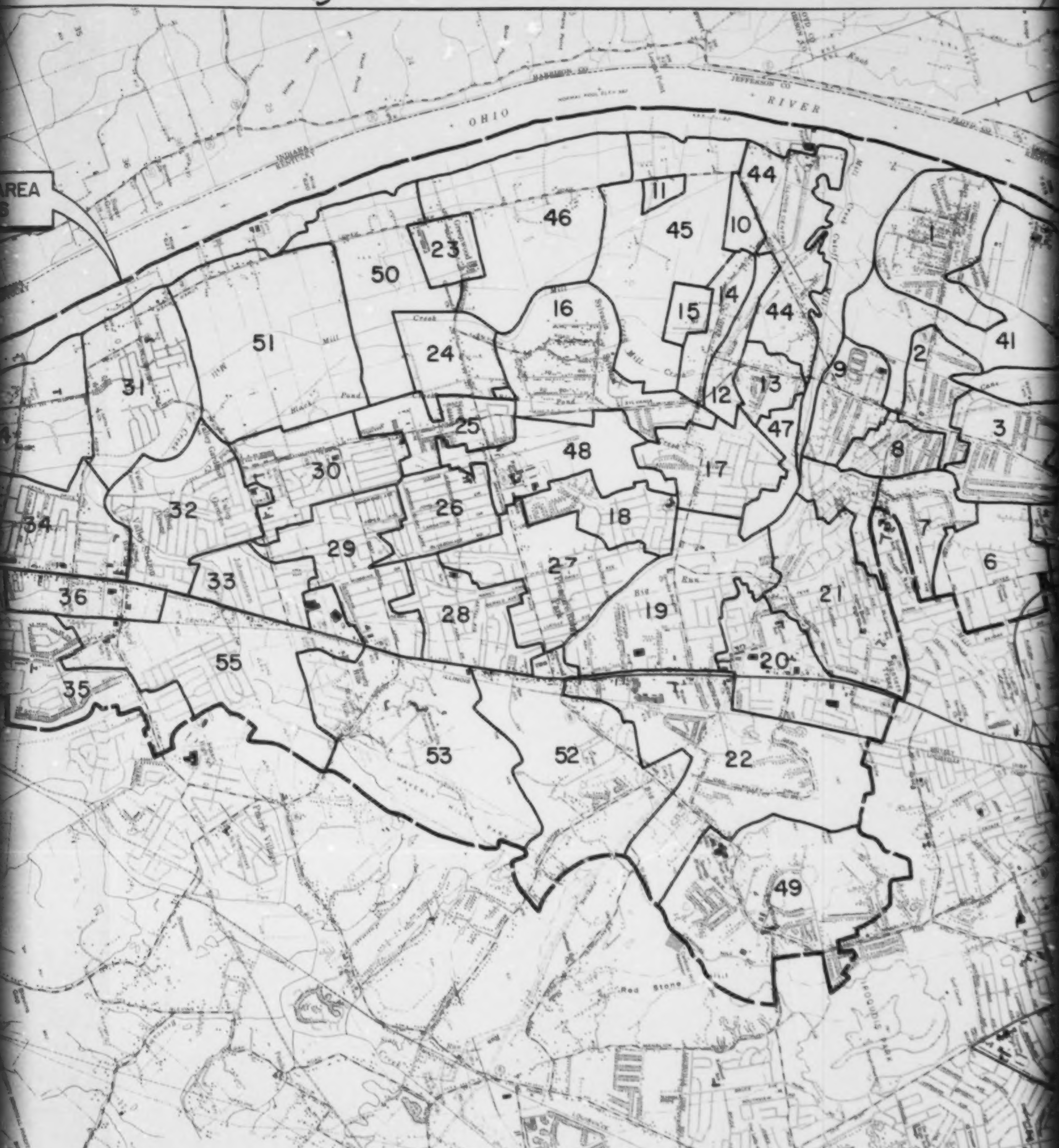
1. Septic tank and seepage pit, and

2. Alternative toilet with septic tank and seepage pit for graywater.

Capital costs of the three general types of alternative toilets are fairly similar, but the composting unit appears to have a somewhat lower operating cost than the other two. Therefore, it was used as a representative of the group.


STUDY AREA LIMITS
OHIO
RIVER
INDIANA
KENTUCKY
HARDIN CO
JEFFERSON CO
NORMAL POOL ELEVATION
31
54
56
40
58
37
34
32
38
33
36
39
57
35
35
55
Creek
Happy Hollow
Mill
Moremens
Hill
Dodge
Dodge Gap
Hill
Headley
Hollow
Miller
Hill
Reardon
Potato Knob
Branch
Hill
NASHVILLE
LOUISVILLE
PIPELINES
ILLINOIS

B



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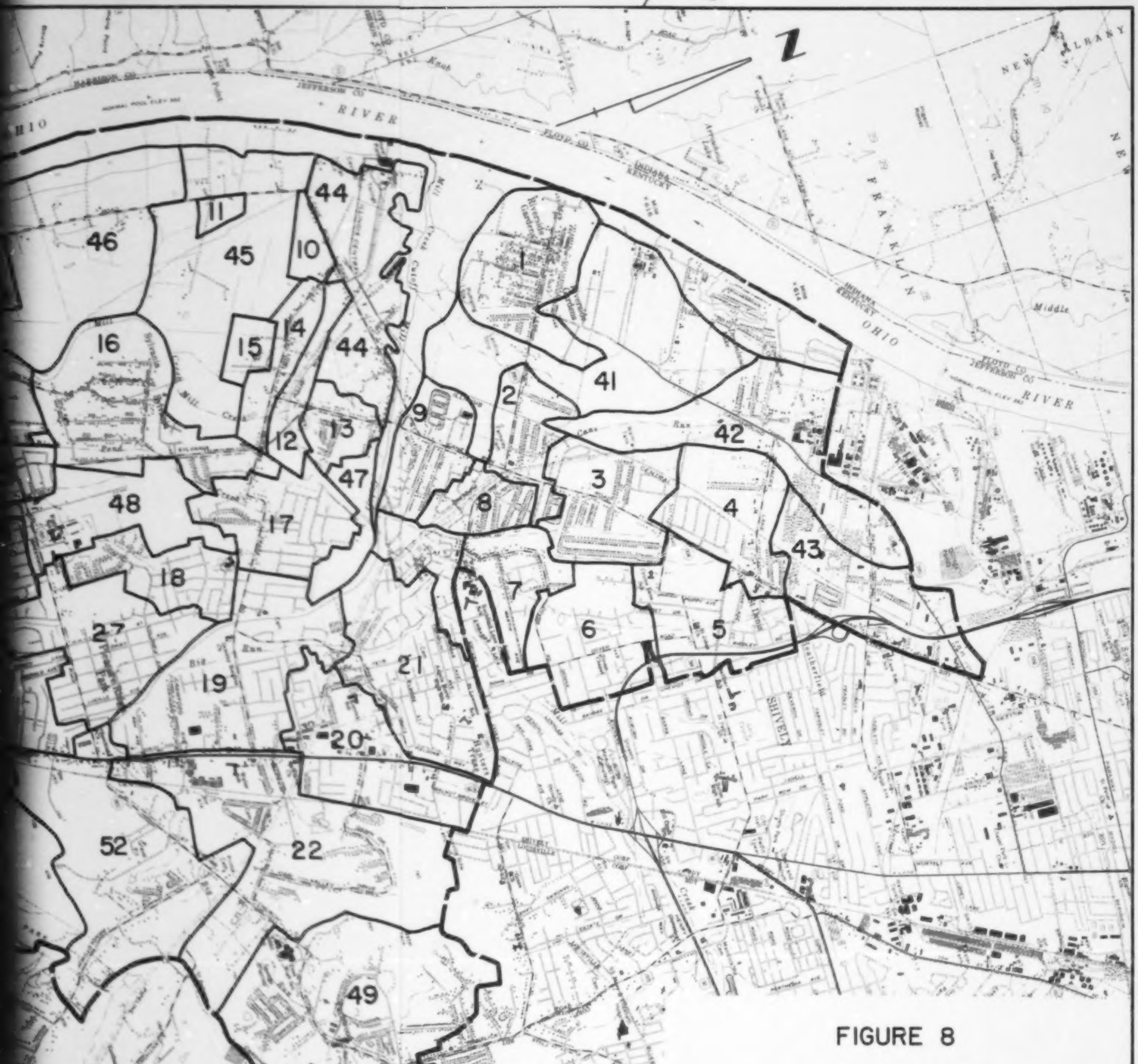

FIGURE 8

MILL CREEK
ENVIRONMENTAL IMPACT STATEMENT
JEFFERSON COUNTY, KENTUCKY

SUB-AREAS

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV ATLANTA, GEORGIA

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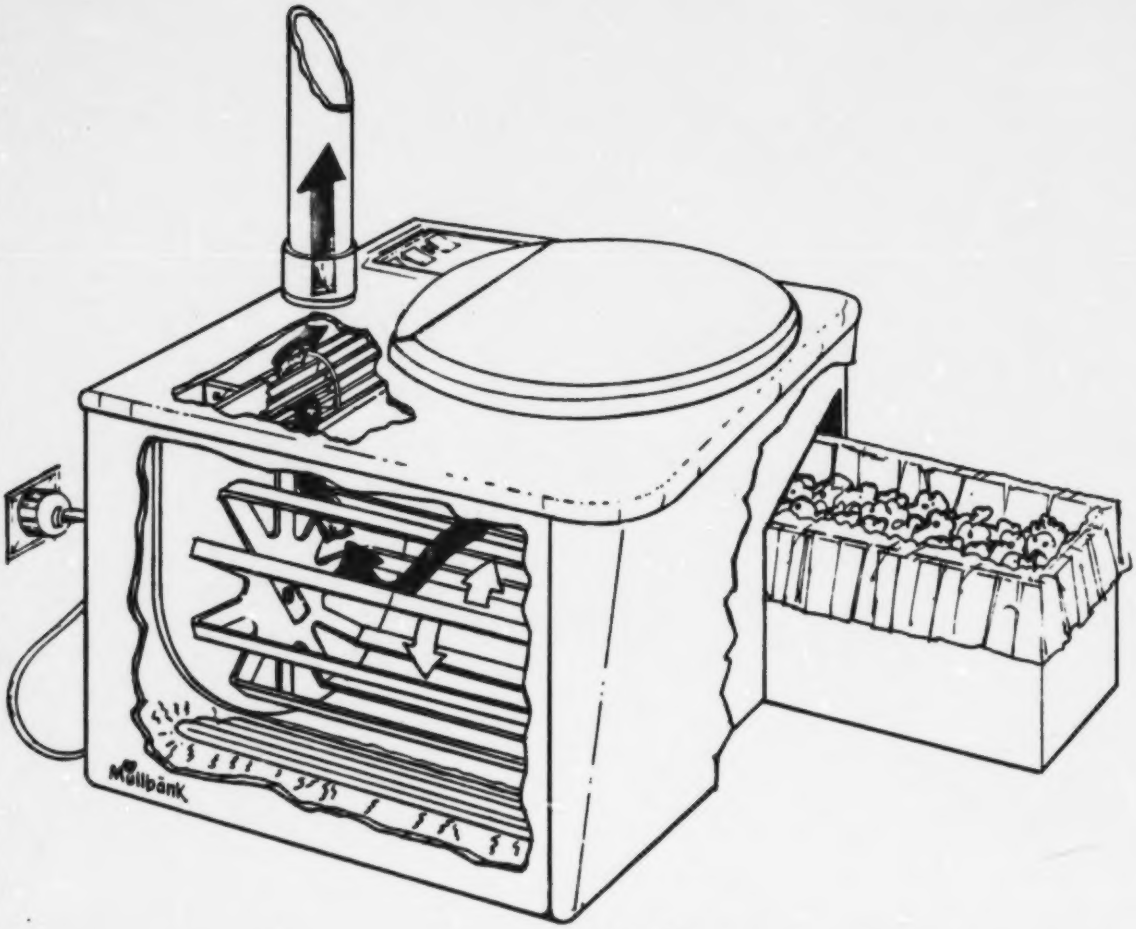
4 P.



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COMPOSTING TOILET

FIGURE 9

3.2.2 Collection Alternatives

Wastewater management alternatives that do not involve waste disposal at the site of waste generation will require the provision of a system for collecting wastewater from each site. The three general types of collection systems in use today are gravity, pressure, and vacuum.

Gravity Collection Systems

Gravity systems are constructed of pipe of 20-cm (8-in.) diameter and larger, installed to maintain a continuous slope to provide for flow of wastewater by gravity. Pipe materials may be vitrified clay, plastic, asbestos cement, cast iron, or portland cement concrete. The pipe system is usually placed at depths sufficient to allow gravity-induced flow of wastewater from each generating unit to the sewer. Pertinent features of a gravity collection system are illustrated in Figure 10.

Small-diameter gravity systems are similar in design and function to conventional gravity systems, except for the diameter of the pipes. Whereas the conventional system is constructed of pipe 20 cm (8 in.) and larger, the small-diameter system may employ pipes as small as 10 cm (4 in.). The smaller-diamter pipes may be tolerated if settleable and floating solids are removed from wastewater before discharge from the source to the sewer system. This removal may be carried out in individual, on-site septic tanks. Some cost-saving over the conventional system is realized for the small-diameter system, due to lower unit prices of smaller pipes. However, the cost of careful septic tank maintenance must be included in an economic analysis, since lack of proper maintenance may allow solids to be carried into the collection system. Such solids would quickly clog the small-diameter sewers.

Gravity collection systems enjoy the general advantage of requiring no input of external energy to cause wastewater flow. However, ground surface relief may require deep trenches for sewer construction under some topographic conditions.

Pressure Collection Systems

Pressure collection systems involve the use of small, low-pressure pumps to move wastewater from individual waste-generation units, or several units, to a discharge point. Two general system arrangements may be utilized; In areas served by existing individual septic tanks, a pump unit may be installed on each septic tank to pump wastewater from individual waste-generating units to a point of discharge. Areas where septic tanks have not been used may be served by small, packaged pump units which receive wastewater from one or several waste-generating units and pump it to a point of discharge.

Pressure systems may be used in areas where topographic conditions would require deep excavations for gravity-sewer construction. Capital-cost savings over gravity systems may accrue due to more shallow excavation and smaller-diameter piping. The pressure system will require input of external energy (electrical) to cause wastewater flow.

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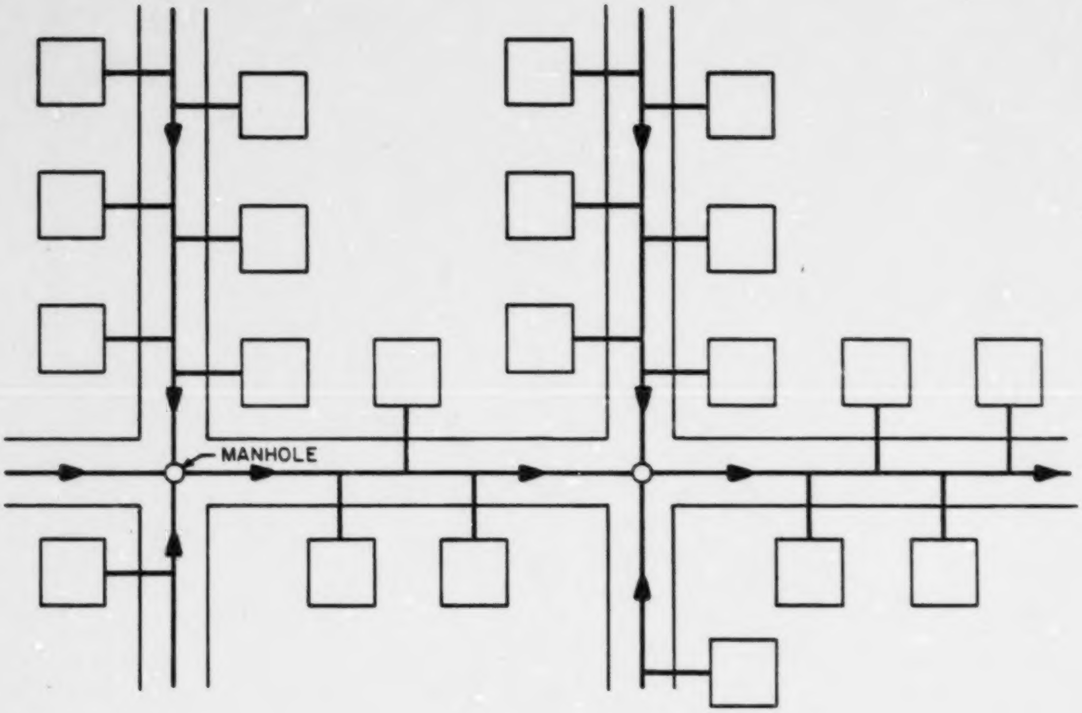
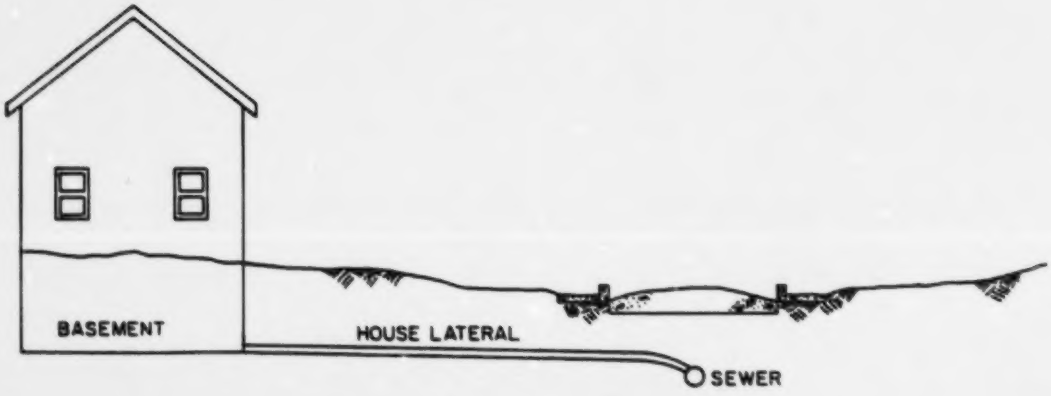


TYPICAL PLAN



TYPICAL HOUSE CONNECTION

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PERTINENT FEATURES OF A GRAVITY COLLECTION SYSTEM

FIGURE 10

Vacuum Collection Systems

The vacuum system utilizes a central vacuum unit to provide the energy for moving wastewater from waste-generating units to a central point of discharge. Pertinent features of a vacuum system are illustrated in Figure 11. Vacuum systems have the same general advantages and disadvantages as pressure systems.

3.2.3 Conveyance Alternatives

Wastewater collection systems may carry flows to one of two general points of discharge:

1. A WWTP which receives wastewater from the relatively small area encompassed by the collection system boundaries, or

2. A system of interceptor sewers which convey wastewater from several collection systems to a regional WWTP.

The two general systems described above, "small-area systems" and "regional systems," are distinguished mostly by system scope. The number of collection systems tributary to a WWTP that make it a regional plant is somewhat arbitrary, and in some situations the difference between the terms "small area" and "regional" may be indistinguishable.

The two concepts do not suffer from ambiguity in the case of Mill Creek. The regional system has been defined by MSD as a system of interceptor sewers and a large WWTP located near the southern end of the study area (see Figure 1).

3.2.4 Centralized Treatment and Disposal Alternatives

Centralized treatment alternatives must be developed in connection with effluent disposal options, for the point of discharge of treated wastewater will ultimately determine the degree of treatment required for environmental and public health protection. Three general effluent disposal points are available: surface waters, land surface, and subsurface. Each of these three disposal points has associated with it a certain set of effluent quality criteria which must be satisfied by wastewater treatment processes.

Surface Water Discharge

The existing surface water effluent limitations for discharges to small streams in the Mill Creek area, as established by the Commonwealth of Kentucky, are shown in Table 7. Wastewaters would require treatment to "advanced secondary" levels to allow their discharge to small streams in the study area. In contrast, effluent discharged to the Ohio River would be required to meet the less stringent standards shown in Table 8. Wastewaters would require treatment to "secondary" levels before discharge to the Ohio River.

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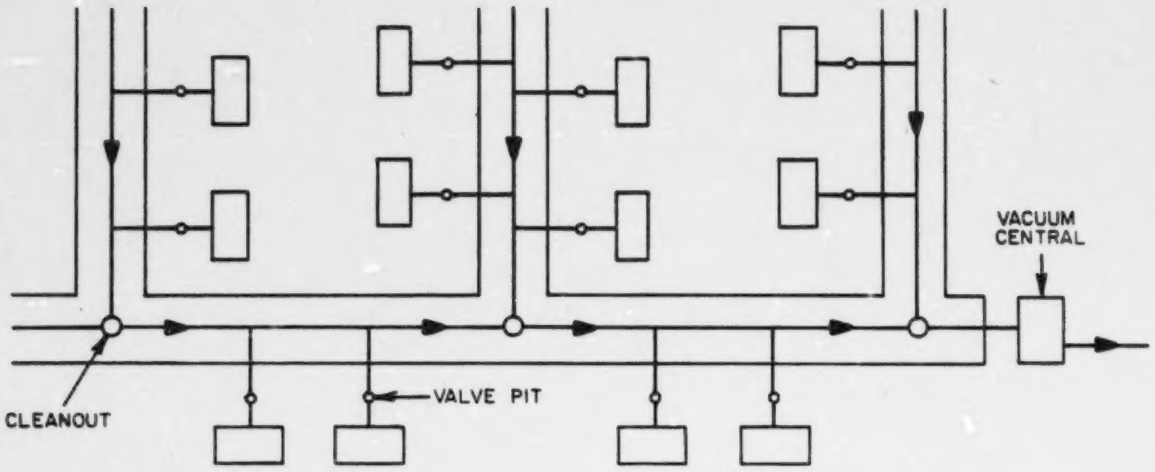
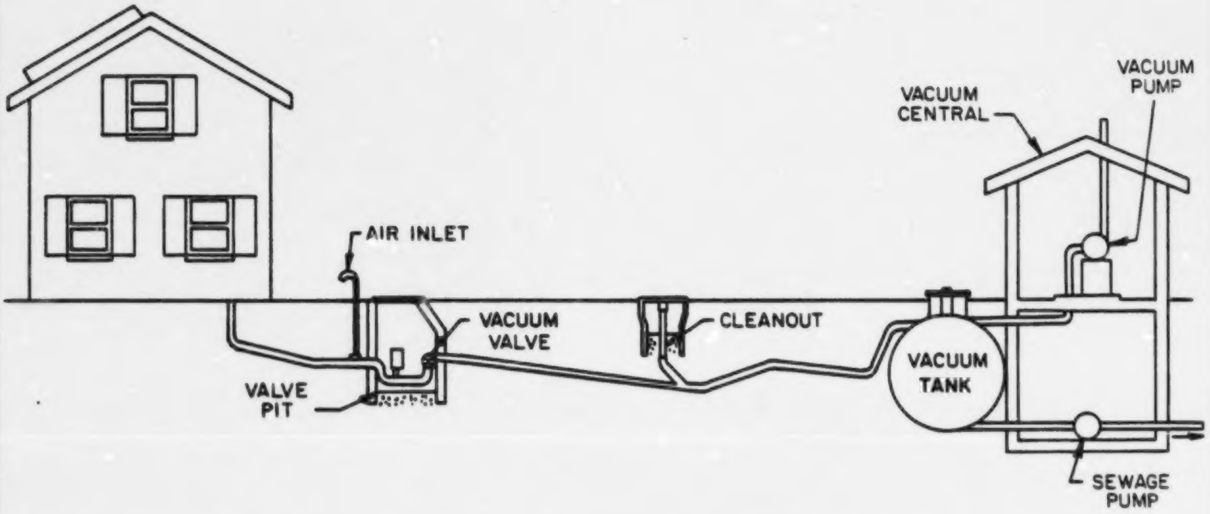


TYPICAL PLAN



HOUSE CONNECTION AND COLLECTION

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PERTINENT FEATURES OF A VACUUM COLLECTION SYSTEM

FIGURE 11

TABLE 7. EFFLUENT LIMITATIONS FOR DISCHARGE TO SMALL STREAMS IN THE MILL CREEK STUDY AREA

Effluent Characteristics	Effluent Limitation	
	Daily Avg.	Daily Max.
Biochemical Oxygen Demand (5-day)	10 mg/l	20 mg/l
Total Suspended Solids	10 mg/l	20 mg/l
Fecal Coliform Bacteria, Number per 100 ml	200	400
Ammonia	4.0 mg/l	8.0 mg/l
Dissolved Oxygen	6.0 mg/l minimum at any time	
pH	not less than 6 and not greater than 9 standard units	
Floating Solids, Visible Foam	No discharge in other than trace amounts	
General	Shall not cause a visible sheen on the receiving water	

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TABLE 8. EFFLUENT LIMITATIONS FOR DISCHARGE TO THE OHIO RIVER IN THE MILL CREEK AREA

Effluent Characteristics	Effluent Limitation	
	Daily Avg.	Daily Max.
Biochemical Oxygen Demand (5-day)	30 mg/1	60 mg/1
Total Suspended Solids	30 mg/1	60 mg/1
Fecal Coliform Bacteria, Number per 100 ml	200	400
pH	not less than 6 and not greater than 9 standard units	
Floating Solids, Visible Foam	No discharge in other than trace amounts	
General	Shall not cause a visible sheen on the receiving water	

Land Application

Discharge to the land requires treatment of wastewater for several purposes:

1. To protect the public from contamination by microbial pathogens borne on aerosols generated in the disposal process;
2. To avoid clogging of spray equipment by wastewater solids; and
3. To avoid clogging of soil surface by wastewater solids.

Generally, "primary treatment" of wastewaters to remove settleable solids and to achieve disinfection should be adequate to meet the needs cited above. Land disposal systems located in areas subject to freezing must be provided with facilities for storage of treated effluent during winter months. Such storage of primary effluent may allow unpleasant odors to develop in the environs of the storage facility. Since land disposal systems in the study area would be located in heavily populated residential areas, it is assumed that treatment requirements for land disposal would be not less than secondary.

Subsurface Discharge

Subsurface discharge of WWTP effluent could be carried out by means of large disposal wells, similar to the seepage pits used throughout the study area for septic tank effluent disposal. Primary treatment would produce an effluent similar to septic tank discharge, with the disinfection of WWTP effluent providing protection of groundwater from pollution by fecal microorganisms. It will be assumed that the minimum level of treatment for subsurface disposal is primary with disinfection.

Regional vs. Small-Area Systems

The MSD regional system would include a West County WWTP located north of Orell Road near Lower River Road, with effluent discharge to the Ohio River. Treatment requirements for an Ohio River discharge are secondary. Small-area treatment plants may be required to provide primary, secondary, or advanced secondary treatment of wastewater, depending on the point of effluent disposal. Sludge handling at each small WWTP under all discharge options will be assumed to consist of hauling of liquid waste sludge to a suitable disposal site, such as municipal wastewater treatment plant.

Planning for centralized wastewater management in large areas usually must include evaluations of the cost-effectiveness of providing one or several regional systems or numerous small-area systems. The evaluation of these two general concepts must include considerations of two key issues:

1. The costs (capital and annual O & M) of the two concepts must be compared; and
2. The environmental impacts of the two concepts must be analyzed.

The environmental impact analysis of the systems may include:

1. Comparison of the water quality impacts of one or several large point-source discharges with the impacts of numerous smaller point-source discharges; and

2. Evaluation of the impacts of development and land use changes fostered or facilitated by the systems.

The impacts of land use changes may include impacts on community services and community character, impacts on transportation facilities and air quality, and impacts of nonpoint-source pollution on the natural environment. Generally, severe environmental impacts from land use changes facilitated by wastewater management systems may occur in situations involving the construction of long interceptors through undeveloped areas to serve isolated developed areas.

Existing Small-Area Systems

Several residential subdivisions, commercial establishments, and institutions in the study area are served by existing small WWTPs. These plants were generally installed to serve wastewater disposal needs of development that occurred after the 1972 Board of Health prohibition of on-site systems for small building lots. Twenty-six small WWTPs, varying in capacity from 11 to 1,900 m^3/d (3,000 to 500,000 gpd), are located within the Mill Creek study area. Nine plants serve residential subdivisions, while the remaining 17 plants serve individual schools, commercial establishments, or apartment buildings.

Each of the 26 existing WWTPs was evaluated as small-area system components. Decisions as to upgrading or expanding to meet discharge-point and service-area requirements were made on a case-by-case basis. Thus, the cost-effectiveness of the two general alternatives (abandoning the WWTP and directing flow to the regional system or maintaining the small WWTP) was evaluated for each plant. The major determinant of the most cost-effective system was cost.

Several existing small-area systems would be able to serve the wastewater disposal needs of existing and future population outside the current service area boundaries. This ability to accept waste flows from "nonsubscribed population" is based on topographic considerations, rather than plant capacity. In most cases, existing reserve capacity is entirely subscribed to by future population inside the current service area. Therefore, service to nonsubscribed population would require capacity expansion. The cost-effectiveness of providing wastewater disposal facilities beyond the original service area will be analyzed on a case-by-case basis for those small WWTPs where the option is reasonable. The private ownership of many of the small WWTPs available for use by nonsubscribed population will be an important issue in determining the practicality of this general option.

Disposal System Design Criteria

Preliminary design of systems for land surface and subsurface disposal of wastewaters treated at small-area WWTPs will be carried out to provide a basis for cost-effectiveness analysis. Land disposal systems will be designed according to the criteria listed below:

Wastewater application rate	2.5 cm (1.0 in.) per week
Storage requirement	50 consecutive days
Buffer zone width	60 m (200 ft)
Application method	fixed sprinklers

A generalized diagram of a land disposal system is presented in Figure 12.

Design for subsurface disposal systems will be governed by the loading rate established by the Jefferson County Sanitary Code (304.406a.12), which requires sufficient seepage-pit bottom area to maintain a wastewater application rate no greater than 40 gpd/ft^2 (2.0 m^3/m^2.d). A generalized diagram of a subsurface disposal system for a small WWTP is presented in Figure 13.

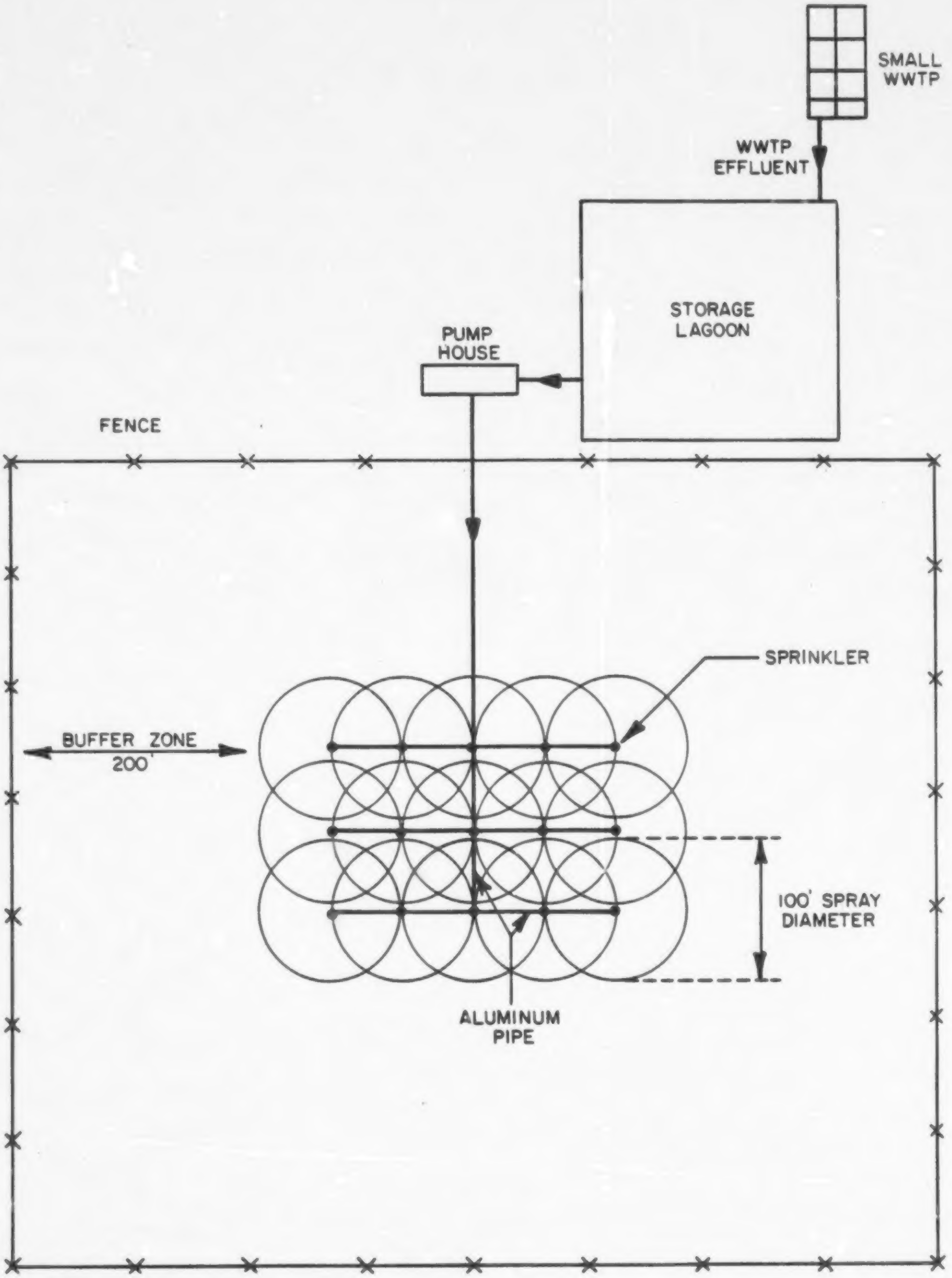
3.3 Wastewater Management Alternatives

3.3.1 Preliminary Evaluation

Each of the collection system alternatives described in the previous section has certain advantages and disadvantages which may be translated into economic terms for specific conditions of housing density, existing wastewater disposal practices, and topography. Thus, the selection of the most reasonable wastewater collection alternative for a particular area may be reduced to a relatively simple least-cost decision.

The costs of the four collection systems were developed and compared for three "candidate subareas": 10, 11, and 23. Subareas 10 and 11 are composed entirely (subarea 11) or mostly (subarea 10) of mobile homes currently discharging wastewater to septic tanks; subarea 10 includes several single-family residences. Subarea 23 comprises both single-family residences and mobile homes. The four collection systems were designed, costs (capital and annual operation and maintenance (O&M)) were developed, and the system with the lowest cost over the planning period was identified. The collection system identified as the least-costly alternative by this analysis was then used, where applicable, as the most-reasonable collection alternative in other subareas.

Conditions existing in individual subareas required specific evaluations of collection-system economics on a case-by-case basis. These specific analyses were carried out and documented, as necessary, during the evaluation of alternatives.



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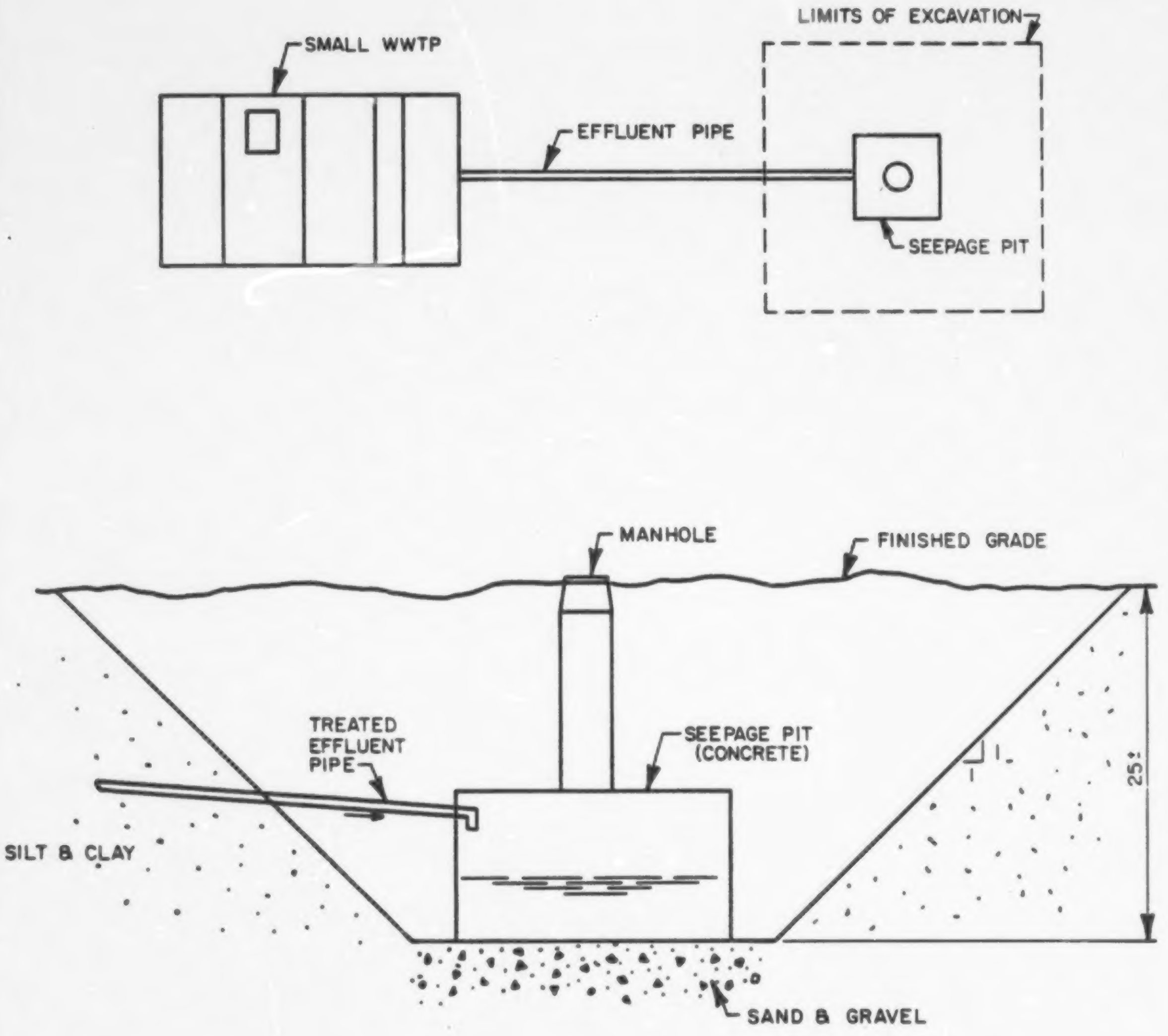
GENERALIZED DIAGRAM OF A LAND DISPOSAL SYSTEM

FIGURE 12



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GENERALIZED DIAGRAM OF A SMALL WWTP SUBSURFACE DISPOSAL SYSTEM

FIGURE 13

The total capital and annual O&M costs for the regional system, as developed by MSD, required completion of several tasks:

1. Preliminary design of West County WWTP,
2. Compilation and updating of cost estimates for collection and interceptor sewers already designed,
3. Preliminary design of collection systems and interceptor sewers not yet designed, and
4. Estimation of system O&M costs attributable to Mill Creek population.

The cost-effectiveness of the regional system and small-area systems in the candidate subareas was determined. These three subareas are compact, fairly isolated and as far removed from the MSD interceptor system as any subarea in the study area. These features favor the implementation of small-area systems. If the regional system was shown to be more cost-effective than small-area systems for wastewater management in candidate subareas, small-area systems were not evaluated for other subareas. If the small-area systems proved to be more cost-effective, they were considered in other subareas.

The cost-effectiveness of maintaining or abandoning each existing small WWTP was also determined.

Several nonregional system alternatives required the identification of the most cost-effective treatment and disposal option for existing and proposed small-area WWTPs. The option thus identified was used as a component of system alternatives which include small-area WWTPs.

3.3.2 Study Area System Alternatives

The wastewater management alternatives for the study area are summarized in Table 9 according to the treatment method proposed for the presently sewered population, the presently unsewered population (i.e., those people currently on septic tanks), and the future population. The first and third alternatives involve shutting down the small treatment plants and converting the dwellings in those areas over to septic tanks or alternative toilets. The third and fourth management systems involve retrofitting all dwellings presently served by septic tanks with alternative toilets. The two subalternatives of the second and fourth management schemes are differentiated by whether or not some of the existing small treatment plants would be expanded to serve everyone within their natural drainage areas. This expansion was considered to be practical only for the small plants serving residential areas, and not for those serving schools or commercial buildings. The fifth alternative involves connecting all future dwellings and all dewllings currently on septic tanks to small-area WWTPs. The sixth alternative involves connecting all dwellings, existing and future, to a regional conveyance and treatment system.

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TABLE 9. ALTERNATIVE WASTEWATER TREATMENT SYSTEMS

Alternative	Population Presently Served by Small Treatment Plants (WWTPs)	Population Presently Served by Septic Tanks	Future Population
1	Abandon WWTPs; convert to septic tanks	Continue use of septic tanks	Use septic tanks
2a	Continue use of WWTPs	Continue use of septic tanks	Use septic tanks or connect to existing interceptor system
2b	Continue use of WWTPs	Connect to WWTPs those dwellings in natural drainage area; continue use of septic tanks for others	Connect to WWTPs those dwellings in natural drainage area; use septic tanks or connect to existing interceptor system for others
3	Abandon WWTPs; convert to alternative toilets	Convert to alternative toilets	Use alternative toilets
4a	Continue use of WWTPs	Convert to alternative toilets	Use alternative toilets
4b	Continue use of WWTPs	Connect to WWTPs those dwellings in natural drainage area; convert others to alternative toilets	Connect to WWTPs those dwellings in natural drainage area; use alternative toilets for others
5	Continue use of WWTPs	Connect to existing or new WWTPs	Connect to existing or new WWTPs
6	Abandon WWTPs; connect to regional conveyance and treatment system	Connect to regional conveyance and treatment system	Connect to regional conveyance and treatment system
7a	Abandon some WWTPs and connect to limited regional system; continue some of other WWTPs	Connect to limited regional system the businesses along Dixie Hwy; continue use of septic tanks for others	Connect to existing or new WWTPs or connect to existing interceptor system
7b	Abandon some WWTPs and connect to limited regional system; continue use of other WWTPs	Connect to limited regional system the businesses along Dixie Hwy; continue use of septic tanks for others	Use septic tanks or connect to existing interceptor system
7c	Abandon some WWTPs and connect to limited regional system; continue use of other WWTPs	Connect to limited regional system the businesses along Dixie Hwy; continue use of septic tanks for others	Connect to limited regional system
8	Abandon some WWTPs and connect to first phase of 201 regional system; continue use of other WWTPs	Connect to first phase of 201 system the businesses along Dixie Hwy; continue use of septic tanks for others	Connect to 201 regional system
9	Continue use of WWTPs	Continue use of septic tanks	Connect to existing or new WWTPs or connect to existing interceptor system

The limited-action alternative, alternative 7, will provide for the collection of wastewater from waste generators in the Dixie Highway corridor. Flows from this largely commercial problem-area will be conveyed to the MSD West County treatment plant. Under 7a and 7b, all other existing population will continue the wastewater management practices now in effect: Future population will use either small WWTPs (7a) or septic tanks or existing interceptors (7b). Under 7c, the interceptors will be sized large enough to provide capacity for future population, and would convey wastewater to the MSD West County treatment plant.

Alternative 8 is the first phase of the 201 regional sewering plan. Interceptors would be constructed to serve the same area that alternative 7a or b would serve, with capacity for future population, and convey wastewater to the West County treatment plant. Alternative 8 is distinguished from alternative 7c by the ability of the 201 system to more readily accommodate future expansion.

The basis against which all system alternatives are measured is alternative 9, the no-action alternative. Under the no-action alternative, existing population maintains present wastewater disposal practices. Unsewered residential and commercial population will continue to discharge wastewater to septic tanks and seepage pits; population currently served by small WWTPs continues to utilize those plants in their present configuration. Future population (residential, commercial, and industrial) utilizes separate WWTPs designed for discharge to streams in the Mill Creek system or to the Ohio River.

A detailed description of each alternative is given below.

System Alternative 1--Septic Tanks

All of the presently sewered population in the study area would be removed from sewers and served by septic tank systems. The areas affected by this conversion are delineated in Figure 2 as sewered areas. Construction activities required to accommodate the conversion are:

1. In cases where the house connection to the sewer exits at the front of the dwelling, but the septic tank location would be in the back of the dwelling (or vice versa), plumbing alterations inside the house would have to be carried out.

2. Septic tank and seepage pit installation would involve excavation to about 4.6 m (15 ft) and 7.6m (25 ft.), respectively. Excavated area and adjacent working area would constitute a tract about 12m (40 ft.) long by 9m (30 ft.) wide.

Many of the existing septic tanks and seepage pits will be 40 to 50 years old by the end of the planning period and may have to be replaced. All future development would be served by septic tank systems.

System Alternative 2--Septic Tanks and Small Treatment Plants

The existing small treatment plants would be maintained and these plants and septic tank systems would be used for future wastewater management. Under alternative 2a, only the presently subscribed existing and future populations would be served by the small plants. All future population, except for "fill-in" in existing treatment plant service areas, would be served by septic tank systems or connect to the existing interceptor system. Under alternative 2b, the small treatment plants service areas would be expanded to encompass all land draining by gravity to the plant. The population presently served by on-site systems in the expanded service areas would be connected to the plant, as would all future development in the expanded service areas. The expanded service areas are shown in Figure 2. Conversion of a typical residence from an on-site system to a sewer would entail the following general activities:

1. As noted for alternative 1, if the sewer location is on the opposite side of the dwelling from the existing discharge to the on-site system, plumbing alterations inside the house would be necessary.

2. Connection to the sewer would involve placement of pipe in a narrow trench about 3m (10 ft.) deep from the dwelling foundation to the sewer. Total width of work area would be about 1.5 to 2.4m (5 to 8 ft.), depending on trench depth and excavating equipment.

System Alternative 3--Alternative Toilets

Alternative toilets would be installed in all residential dwelling units. Existing commercial establishments would continue to be served by existing installations; future commercial establishments would be served by septic tank systems. Virtually all existing residential units would be required to convert to alternative toilets by carrying out the following activities:

1. Water-carriage toilets would be removed and replaced by alternative toilets.

2. Dwellings currently served by sewers would require installation of septic tank systems for disposal of graywater (water from sinks, washing machines, diswashers). This activity would involve the construction activities noted under alternative 1.

The prototype alternative toilet selected for comparative purposes is illustrated in Figure 9. The unit receives human waste in an electrically heated chamber, where composting occurs. Periodic mixing of the contents of the composting chamber is carried out by manual operation of the external crank. Routine maintenance of the unit requires emptying the tray holding composted waste materials about once a month for a typical household. Composted wastes may be applied to the homeowner's lawn, shrubs, or flower bed, or it may be disposed of along with household solid waste.

System Alternative 4--Alternative Toilets and Small Treatment Plants

Alternatives 4a and 4b are similar to 2a and 2b, with alternative toilets serving as the on-site option for the population not connected to small-area treatment plants. The existing sewered population would continue to be served by the small plants. The existing population currently served by septic tank systems would convert to alternative toilets under alternative 4a. Activities pertaining to conversion to and operation of an alternative toilet are described under alternative 3. Alternative 4b would involve expanding the service areas of existing treatment plants as described under alternative 2b and shown in Figure 2. Activities involved in conversion of a residence from an on-site system to a sewer are described under 2b.

System Alternative 5--Small Treatment Plants

Use of the existing small treatment plants would continue, and all existing residential and commercial population currently served by on-site systems would be connected to existing or new small plants. All future population would also be served by existing or new small plants. Alternative 5 was evaluated for three "candidate subareas" to compare its general economic attractiveness to that of the regional sewer system. Subareas 10, 11, and 23 (Figure 8) were selected as test areas because they are located on the fringe of the proposed regional system. The relatively high cost of extending the regional interceptor to these subareas should provide cost ratios (small-area system: regional system) as favorable to small-area systems as could be found for any subarea in the study area. The assumption implicit in this approach is that if small-area systems would be uneconomical compared to the regional system in subareas 10, 11, and 23, then small-area systems would be uneconomical in all other subareas.

Collection-system alternatives evaluated for the candidate subareas were gravity sewers, vacuum sewers, and pressure sewers. Treatment/discharge alternatives included:

1. Advanced wastewater treatment (activated sludge with nitrification, filtration, disinfection, reaeration) with discharge to a nearby surface waterway;

2. Secondary wastewater treatment (activated sludge, disinfection) with application by spray irrigation to nearby land; and

3. Primary treatment (sedimentation, disinfection) with discharge to sub-surface seepage wells.

The cost analysis of small-area and regional wastewater management in the candidate subareas in described in Section 3.4.1.

System Alternative 6--Regional Treatment Plant

The regional alternative is essentially the plan selected for the Mill Creek area in the 1974 Water Quality Management Plan (the 201 Plan) (Schimpeler-Corradino Associates 1974). This alternative involves complete sewering of the Mill Creek area with conveyance of all wastewater to a new treatment plant located near the southern end of the study area (Figure 1). Activities related to alternative 6 include the following:

1. The population currently served by small treatment plants will be largely unaffected; connection to the regional system will occur at the small plants.
2. Placement of collector and interceptor sewers will involve extensive construction activities affecting many roads in the area.
3. Activities involved in conversion of current on-site units to sewers are described under alternative 2b.

It should be noted that this portion of the alternatives evaluation is concerned only with residential and commercial wastewater management. Industrial flows will not be considered, nor will costs of system capacity allocated to industrial wastewaters be included with the costs of residential and commercial facilities.

System Alternative 7--Limited Regional System

Alternative 7 involves the limited action of providing a regional sewer system to serve several specific portions of the Mill Creek study area:

1. The Dixie Highway corridor,
2. The sewered residential developments along St. Andrews Church Road,
3. Several other sewered residential developments in the Waverly Hills area,
4. The Valley Village subdivision, and,
5. Several other small treatment plants.

This alternative consists of providing several interceptor sewers, as shown in Figure 3, to connect to existing MSD interceptors leading to the West County treatment plant. The Dixie Highway commercial district would be provided with relief from severe wastewater disposal problems. Further, several small treatment plants in the study area, which were originally conceived as temporary plants, will be relieved (the number in parenthesis is keyed to Figure 2):

Valley Village Subdivision (1)
Valley High School (2)
Villa Anna (3)

Beth Haven Baptist Church (4)
Westland Mall (6)
Timothy Hills Subdivision (7)
Eden Apartments (8)
Waverly Hills Apartments (10)
S.W. Jefferson County Government Center (13)
R&W Laundromat (15)
Havalock Subdivision (16)
Silver Palms Swim Club (17)
Cardinal Mobile Home Park (18
Fordhaven Subdivision (19)
West Springfield Subdivision (20)
Forest Hills Subdivision (21)
River Valley Mobile Home Park (24)
Woodhaven Medical Services (26)

The population not included in the service area of the limited regional system would continue with existing wastewater management systems, and future growth would be served by one of three possible alternatives:

1. In 1978 the Louisville and Jefferson County Board of Public Health effectively prohibited the installation of septic tanks on lots smaller than 2 ha (5ac). Under alternative 7a, that prohibition would remain in force, and virtually all future population would be served by existing sewers and small-area treatment plants.

2. Under alternative 7b, the septic tank prohibition would be removed, allowing future residential population to be served by on-site systems similar to those now used in the study area. Commercial and institutional wastewater management needs would be met with small treatment plants.

3. Under alternative 7c, the interceptors would be constructed large enough to provide capacity for future residential population.

The existing Black Pond Interceptor would, of course, be available to serve future populations under all three sub-alternatives.

System Alternative 8--First Phase of the 201 Regional System

The objective of alternative 8 is the same as that of alternative 7: to provide relief for existing problem-areas along the Dixie Highway corridor, and to relieve several of the small treatment plants. Alternative 8 would provide for the relief of the same small treatment plants as those in alternative 7 plus two more:

Eisenhower Elementary School (9)
Kerrick Elementary School (22)

The interceptors would provide capacity for future population. This alternative allows for expansion should it become necessary to sewer other areas in the future. Alternative 8 is shown in Figure 4.

System Alternative 9--No Federal Action

The no-federal-action alternative (often simply called the "no-action" alternative) is described by considering the present situation in the Mill Creek area and projecting the future conditions with no changes in public policy or private practices. Thus, the no-action alternative must be projected as developing under the constraint imposed by the Board of Health prohibition of on-site wastewater disposal systems for single-family dwellings on lots smaller than 2 ha (5 ac). The continuance of this policy will extend the current development pattern in the study area, i.e., small-area wastewater collection, treatment, and discharge to surface waters. It must also be assumed that the July, 1979, effluent standards included in all NPDES permits for the existing small treatment plants will be enforced, requiring the upgrading of all small plants.

Under the no-action alternative the Mill Creek area in 1995 will be characterized as follows:

1. The original residences in the area will be served by on-site systems comprising septic tanks and seepage pits. Many on-site units will be 40 to 50 years old and may have to be replaced.
2. Many commercial establishments will continue to depend upon on-site disposal systems. Many others will be forced to install treatment units for surface-water discharge, because of repeated seepage pit failures.
3. Small treatment plants installed with subdivisions developed in the late 1960s and early 1970s will be about 25 years old.
4. Virtually all residential and commercial development after 1980 will have been served by sewers and small treatment plants with surface water discharge or connect to the existing interceptor system. Most small plants will be privately owned and operated.
5. Industrial growth, as it will have occurred, will be served by individual industrial waste treatment systems with surface-water discharge.

3.3.3 Riverport Alternatives

The Riverport Industrial Park and Foreign Trade Zone is located along the Ohio River in the Mill Creek Area and occupies over 1600 acres of river front land (See Figure 1). Riverport is currently developing the industrial park, but as of this time no industrial subscribers have been established.

With regard to wastewater management, there are three general alternatives for management of industrial wastewaters from the Riverport complex.

Wastewaters may be pretreated, if necessary, and:

1. collected and conveyed to the proposed MSD interceptor sewer system;

2. collected and treated at a central Riverport facility; or

3. handled and disposed of by each industry.

Since it is not yet known what type or how many industries will be developed at Riverport, the evaluation of Option 3 is not possible at this time.

3.4 Evaluation of Alternatives

3.4.1 Cost Evaluation

Preliminary Analysis--System Alternative 5

As noted in the description of alternative 5, wastewater collection alternatives and wastewater treatment/discharge alternatives were analyzed for subareas 10, 11, and 23. The results of these preliminary economic analyses were used as indicators of the least-cost alternative for sewering the other subareas in the study area.

Wastewater Collection Alternatives

Gravity sewers in the three subareas have a lower capital cost than either vacuum or pressure sewers. Moreover, gravity sewers always have a lower operating cost, because of the cost of electricity and pump maintenance for vacuum and pressure sewers.

In these three subareas, the estimated capital cost and the present worth of that capital cost are:

Subarea	Sewer Type	Capital Cost	Present Worth
10	Gravity	$ 554	$ 331
	Vacuum	841	555
	Pressure	642	449
11	Gravity	476	285
	Vacuum	798	533
	Pressure	813	569
23	Gravity	1,000	598
	Vacuum	1,467	962
	Pressure	1,612	1,137

Gravity collection systems will be used in the cost analysis of sewering alternatives in the study area.

Wastewater Treatment/Discharge Alternatives

Cost were developed for the following systems, each receiving wastewater flow at the terminus of the collection system:

1. Advanced wastewater treatment with surface water discharge;

2. Secondary wastewater treatment with land application;
3. Primary wastewater treatment with subsurface discharge; and
4. Conveyance through the regional interceptor system to the regional treatment plant, with discharge to the Ohio River.

The costs of each treatment/discharge alternative for the candidate subareas are summarized in Table 10. The regional system appears to be the least-cost treatment/discharge option in these test subareas, so alternative 5--the use of small-area treatment plants throughout the study area--will not be evaluated further.

Development of Costs

Capital and annual operating costs have been estimated for each of the remaining system alternatives on both a subarea and regional basis. Although the treatment processes have been planned out in some detail and every effort has been made to ensure that the costs of each process are reasonable, it should be recognized that there is some level of uncertainty inherent in any attempt to plan for the future. Indeed, with the level of detail used in a study like this one, error limits up to ±30 percent can be expected (Weaver 1973). The objective at this point in the EIS process is not to define what the charge to the users of each system will be, but rather to develop costs that are internally consistent and allow a valid comparison of alternatives. After one alternative has been selected as being cost-effective in relation to the others, it can be examined in more detail to refine the cost estimate and substantially reduce the level of error.

Unit costs of treatment have been estimated in 1979 dollars from data available to Gannett Fleming Corddry and Carpenter, Inc., and from U.S. EPA handbooks. The bases for estimating the cost of each process or unit are listed in Table 11; costs for excavation and backfill and engineering fees were included where appropriate.

On-site Systems

The number of on-site treatment units was estimated for the present population and for the 1995 population projected by MSD. The existing number of dwellings served by septic tanks and seepage pits was derived from analysis of the billing records of the Louisville Water Company and by counting buildings on 1975 aerial photographs. The additional number of on-site systems to be installed by 1995 was calculated by dividing the population increase between 1972 and 1995 by 3.5 persons per single-family dwelling unit, the 1975 average household size (Louisville and Jefferson County Planning Commission 1978). Each apartment building was assumed to use two septic tank systems. Because septic tanks serving commercial establishments in the study area have an unusually high failure rate, they will be replaced, for the purposes of the cost analysis, by an underground aerobic unit that is better able to provide adequate treatment.

TABLE 10. CAPITAL AND OPERATING COSTS AND PRESENT WORTH FOR ALTERNATIVE 5
(In Thousands of 1979 Dollars)

	Capital Cost	Average Annual Operating Cost	Present Worth
Subarea 10			
Advanced treatment with surface water discharge	410	26	460
Secondary treatment with land application	980	22	880
Primary treatment with subsurface discharge	370	21	410
Regional treatment plant	110	5.5	110
Subarea 11			
Advanced treatment with surface water discharge	350	21	430
Secondary treatment with land application	830	26	740
Primary treatment with subsurface discharge	310	17	330
Regional treatment plant	90	4.1	84
Subarea 23			
Advanced treatment with surface water discharge	660	36	700
Secondary treatment with land application	1900	49	1640
Primary treatment with subsurface discharge	960	28	900
Regional treatment plant	290	11	260

TABLE 11. UNIT COST ESTIMATES FOR ON-SITE SYSTEMS AND SMALL TREATMENT PLANTS

	Capital Cost ($)	Operations and Maintenance Cost ($)
Septic Tanks/Seepage Pits		
Single-family dwelling	1,800	40/yr.
Multi-family dwelling and business	3,600	80/yr.
Aerobic Tanks	2,300	250/yr.
Alternative Toilets		
Single-family dwelling	1,700	110/yr.
Multi-family dwelling	17,000	1100/yr.
Polyvinyl Chloride Pipe		
1-1/2-inch	1.85/ft.	
2-1/2-inch	2.25/ft.	
3-inch	2.55/ft.	
4-inch	3.00/ft.	
6-inch	4.35/ft.	
Vitrified Clay Pipe, Extra Strength		
8-inch	5.60/ft.	
10-inch		
12-inch	5.53/ft.	
15-inch	9.68/ft.	
18-inch	13.83/ft.	
Reinforced Concrete Pipe, Class IV		
30-inch	29.63/ft.	
27-inch (with trench 18-20 ft. deep)	89.57/ft.	
30-inch (with trench 18-20 ft. deep)	99.53/ft.	
36-inch (with trench 18-20 ft. deep)	124.41/ft.	
Reinforced Concrete Pipe, Extra Strength		
42-inch (with trench < 20 ft. deep)	159.24/ft.	
42-inch (with trench > 20 ft. deep)	184.13/ft.	
Aluminum Pipe, 6-inch	3.55/ft.	
Vitrified Clay Pipe[a]		
10-inch (with trench < 8 ft. deep)	41.54/ft.	
10-inch (with trench 8-14 ft. deep)	46.73/ft.	
10-inch (with trench 14-20 ft. deep)	57.11/ft.	
10-inch (with trench 20-30 ft. deep)	77.88/ft	
10-inch (with trench > 30 ft. deep)	98.65/ft.	
12-inch (with trench 8-14 ft. deep)	51.92/ft.	
12-inch (with trench 14-20 ft. deep)	62.31/ft.	
12-inch (with trench > 20 ft. deep)	83.07/ft.	
15-inch (with trench < 8 ft. deep)	51.92/ft.	
15-inch (with trench 8-14 ft. deep)	57.11/ft.	
15-inch (with trench 14-20 ft. deep)	67.50/ft.	
15-inch (with trench 20-30 ft. deep)	88.27/ft.	
15-inch (with trench > 30 ft. deep)	109.03/ft.	
18-inch (with trench 8-14 ft. deep)	72.69/ft.	
18-inch (with trench > 20 ft. deep)	88.27/ft.	
21-inch (with trench 8-14 ft. deep)	83.07/ft.	
21-inch (with trench 14-20 ft. deep)	98.65/ft.	
21-inch (with trench 20-30 ft. deep)	119.42/ft.	
21-inch (with trench > 30 ft. deep)	145.38/ft.	

TABLE 11. (CONT.)

	Capital Cost ($)	Operations and Maintenance Cost ($)
24-inch (with trench 8-14 ft. deep)	88.27/ft.	
24-inch (with trench > 30 ft. deep)	150.57/ft.	
27-inch (with trench 8-14 ft. deep)	98.65/ft.	
27-inch (with trench 20-30 ft. deep)	140.19/ft.	
27-inch (with trench > 30 ft. deep)	166.15/ft.	
30-inch (with trench 8-14 ft. deep)	109.03/ft.	
36-inch (with trench 8-14 ft. deep)	124.61/ft.	
36-inch (with trench 14-20 ft. deep)	145.38/ft.	
36-inch (with trench 20-30 ft. deep)	176.53/ft.	
36-inch (with trench > 30 ft. deep)	202.49/ft.	
42-inch (with trench 14-20 ft. deep)	160.95/ft.	
42-inch (with trench > 20 ft. deep)	192.11/ft.	
Manholes		
4-ft. diameter, 8-10 ft. deep	525.00	
4-ft. diameter base	205.00	
4-ft. diameter riser	58.25/vert. ft.	
5-ft. diameter base	746.45	
5-ft. diameter riser	99.53/vert. ft.	
6-ft. diameter base	1492.91	
6-ft. diameter riser	149.29/vert. ft.	
Manhole Frames and Covers		
2-ft. diameter standard	220.00	
2-ft. diameter watertight	300.00	
Trench Excavation and Backfill		
3-ft. deep, 1-1/2-3 in. pipe	3.65/ft.	
8-10 ft. deep, 4-6 in. pipe	17.50/ft.	
8-10 ft. deep, 8-in. pipe	18.05/ft.	
10-12 ft. deep, 8-in. pipe	21.85/ft.	
Other	16.70/yd^3	
Bulk excavation and backfill	4.35/yd^3	
Bulk excavation	3.00/yd^3	
Pavement replacement	13.35/yd^2	
Vacuum equipment	V(b)	
Vacuum central	V	
Valve pits	450 ea.	
Septic tank effluent pump (installed)	2,000	
Pipe		V
Electricity		.03/kw-hr
Package treatment plant	V	
Sand filter	V	
Holding tank	V	
Chlorine		.20/lb
Labor		V
Miscellaneous supplies		V

TABLE 11. (CONT.)

	Capital Cost ($)	Operations and Maintenance Cost ($)
Administration and laboratory		3,000/yr.
Seepage pit for package plant	33.78/ft.^{2}	
Land	5,000/ac	
Nozzle for spray irrigation	15.00 ea	
Riser for spray irrigation	3.00 ea	
Spray irrigation pump	V	
Pond liner	1.00/ft.^{2}	

(a) Costs include installation, excavation and backfill, pavement replacement, and traffic control.

(b)V: Cost varies with size of the equipment or facility; individual costs determined from cost curves or data from manufacturer's representatives.

Note: \$/ft. x 3.28 = \$/m

\$/yd.^{3} x 1.308 = \$/m^3

\$/yd.^{2} x 1.196 = \$/m^2

\$/ft.^{2} x 10.76 = \$/m^2

\$/ac. x 2.47 = \$/ha.

For determining the number of alternative toilet systems, it was assumed that one composting toilet would be installed in each single-family dwelling unit, and that septic tanks and seepage pits would be installed wherever they did not already exist. (Although a smaller-than-normal septic tank system may be acceptable for use with alternative toilets, it is also likely that the average single-family dwelling will need more than one composting toilet; in sum, therefore, the costs for alternative toilet systems are probably underestimated in this analysis.) Ten composting toilets and two septic tank systems were assigned to each apartment building; but the toilets were not thought to be suitable for schools or commercial establishments, so only septic tank systems were considered for those buildings.

Small-area Treatment Plants

Current wastewater flows to the small treatment plants were obtained from the records of the Louisville and Jefferson County Department of Public Health and the Kentucky Department for Natural Resources and Environmental Protection. Flows in 1995 are MSD design flows, which, in turn, are based on a generation rate of 400 L/d (105 gpd) per person. The capital and operating costs for the 26 small treatment plants are listed in Table 12.

The capital costs in the "A" column of Table 12 include the upgrading necessary to meet discharge standards or the installing of the new disposal method; these costs were used in the analyses of alternatives 2a, 4a, 7, and 8. These costs also include replacing completely those plants that will be 30 years old before the end of the planning period:

Cardinal Mobile Home Park
Kerrick Elementary School
Pleasure Ridge Park High School
Sanders Elementary School
Valley High School
Valley Village Subdivision
Villa Anna Subdivision

This replacement was assumed to occur in 1985 in conjunction with the up-grading of the plants. While the costs for replacing the other plants may not occur during the EIS planning period, it should be noted that most of them will have to be replaced in the ten years after 1995 if they continue to be used.

The capital costs in the "B" columns of Table 12 apply only to those plants that would be expanded in alternatives 2b and 4b to serve their entire natural drainage area. These costs include completely replacing those plants as well as expanding them. Replacement is necessary because all of these plants will be nearing the end of their expected life by the end of the planning period, and it would be more reasonable to replace the existing structures at the time the expansion is undertaken rather than to wait a few more years and have to disrupt operations again. The exception to this procedure is the treatment plant for the Waverly Hills apartments, which was built in the late 1970s and only recently began operation. With subsurface discharge, the existing plants were expected to use the secondary treatment capability that they already had in place. Replaced and expanded plants,

TABLE 12. CAPITAL AND ANNUAL OPERATING COSTS FOR THE SMALL WASTEWATER TREATMENT PLANTS (In Thousands of 1979 Dollars)

	Map Key	Advanced Treatment With Surface Water Discharge				Primary or Secondary Treatment With Subsurface Discharge				Secondary Treatment Wi Land Application			
		Capital Cost		Operating Cost		Capital Cost		Operating Cost		Capital Cost		Operating Cost	
		A	B	1985	1995	A	B	1985	1995	A	B	1985	1995
Beth Haven Baptist Church	4	62	--	16	16	71	--	13	13	330	--	18	18
Cardinal Mobile Home Park	18	220	--	17	17	170	--	14	14	360	--	18	18
Conway Middle School	12	47	--	12	12	37	--	9	9	220	--	13	13
Eden Apartments	8	64	490	17	20	76	370	14	15	500	1,000	22	25
Eisenhower Elementary School	9	47	--	11	11	36	--	8	8	340	--	15	15
Fordhaven Subdivision	19	200	2,700	34	56	250	2,100	28	43	1,300	4,700	45	77
Forest Hills Subdivision	21	460	5,000	55	88	450	4,100	47	71	2,500	8,500	80	130
Havalok Subdivision	16	140	3,900	31	76	150	3,100	27	60	870	6,900	39	120
Johnsontown Elementary School	25	417	--	12	12	38	--	9	9	190	--	12	12
Kerrick Elementary School	22	140	--	11	11	110	--	8	8	340	--	14	14
Pleasure Ridge Park High Sch.	11	480	--	22	22	340	--	16	16	970	--	26	26
R & W Laundromat	15	47	--	11	11	32	--	9	9	210	--	12	12
River Valley Mobile Home Park	24	52	450	19	23	61	330	15	18	300	830	20	26
S. W. Jeff. Co. Gov't. Cent.	13	0	--	11	11	--	--	--	--	--	--	--	--
Sanders Elementary School	5	140	--	11	11	110	--	8	8	240	--	11	11
Schacklette, Wade School	14	110	--	11	11	27	--	9	9	150	--	11	11
Silver Palms Swim Club	17	100	--	11	11	17	--	9	9	120	--	11	11
Timothy Hills Subdivision	7	150	780	35	42	170	460	30	34	930	1,700	42	50
Valley High School	2	510	--	23	23	340	--	17	17	1,200	--	28	28
Valley Village Subdivision	1	2,100	--	83	83	1,200	--	67	67	--	--	--	--
Villa Anna Subdivision	3	1,300	--	58	58	750	--	47	47	2,900	--	75	75
Waverly Hills Apartments	10	90	400	0	35	100	430	0	30	520	1,200	0	43
Woodhaven Medical Services	26	120	--	30	30	160	--	23	23	830	--	35	35
Wellington, Sara Belle School	23	47	--	11	11	26	--	9	9	130	--	10	10
West Springfield Subdivision	20	300	3,000	42	60	310	2,300	36	47	1,700	5,200	59	85
Westland Mall	6	52	1,300	16	39	61	920	11	30	610	2,100	17	44

Note: Capital costs include treatment plant construction, land acquisition, collector system construction, and engineering fees. Operating costs cover treatment plant and conveyance system. Dashes used where expansion of the service area is not likely.

however, were assumed to use only primary treatment before subsurface discharge, which makes them comparable to using septic tanks for on-site treatment.

The operating costs in Table 12 reflect the flows in 1985 and 1995. The 1995 costs are different only where the plant will expand and future flows will increase.

Regional Treatment System

Cost estimates for the regional treatment plant are based on the preliminary draft Final Design Report Summary for the West County wastewater treatment plant which was prepared for MSD by CH_2M Hill. The costs, adjusted to 1979 prices, are shown in Table 13. These costs have not been approved by EPA.

In order to be consistent with the other alternatives, costs for sludge disposal (capital cost of sludge trucks and operating costs for sludge disposal) were not included in the costs for the regional system. The total cost of the 2.19 m^3/s (50-mgd) plant was based on the total flow to the plant, which includes contributions from Shively and the Pond Creek interceptor (which brings in flow from outside the study area), and industry as well as from the residents of the Mill Creek area. Only the portion of the costs attributable to Mill Creek residents was used for the present worth analysis. The capital cost of the regional interceptor is based on MSD's estimated construction cost, adjusted to 1979 prices. Collector-system capital costs came from MSD's estimated construction costs for segments that have already been designed or from a preliminary design based on the number of dwelling units projected for the service area. For the present worth analysis the conveyance system costs were also prorated to reflect only the residential wastewater flows. The cost breakdown for the regional conveyance and treatment system is shown in Table 14.

Present Worth Analysis

The purpose of the present worth analysis is to relate the total costs (capital and operating) of each wastewater treatment alternative over the planning period to an equivalent investment cost at the beginning of the period, given a fixed rate of return on that investment. By doing this, dollars spent on construction at the beginning of the planning period are made equivalent to dollars spent on operating costs at the end of the planning period, when the value of each dollar has decreased. Therefore, the total cost of a project with a high initial capital cost and a low operating cost can be more equitably compared with the cost of a project with a low initial cost but a high operating cost.

The following assumptions formed the basis for the present worth analysis:

TABLE 13. COST ESTIMATES FOR REGIONAL TREATMENT PLANT

Unit	Capital Cost
Influent Screening Chamber Modifications	26,100
Raw Wastewater Pumping Station Modification	795,400
Grit Removal Basins	612,400
Grit Handling Building	437,300
Primary Clarifiers	1,886,700
Primary Sludge and Scum Pump Stations	483,500
Aeration Basins	6,320,600
Blower Building	1,716,400
Secondary Clarifiers	4,565,500
Secondary Sludge Pumping Complex[a]	972,000
Chlorine Contact Basins	1,482,100
Chlorination Building	810,100
Effluent Pump Station	1,134,800
Sludge Thickening Facilities	2,119,700
Anaerobic Digesters	2,957,300
Digester Control Galleries	4,783,200
Sludge Dewatering Facilities	3,917,800
Sludge Storage Facilities (liquid and dewatered)	2,296,200
Maintenance Facility and Inventory Building	4,326,900
Operations Center	2,864,200
Generator Building	4,510,600
Vehicle Storage Building and Maintenance	631,600
Flammable Storage Building	61,200
Piping	13,401,600
Sitework	6,421,700
Electrical (Includes Automatic Circuit Switching)	7,224,500
Instrumentation and Control (I&C)	3,210,900
Subtotal	79,970,300
Plus 35%	27,989,600
	107,959,900

Operation and Maintenance	1985	1995[b]
Labor	1,355,800	2,407,500
Energy	220,300	391,300
Chemicals	217,800	386,700
Materials and Supplies	469,700	834,100
Total	2,263,600	4,019,600

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[a] Includes engineering, administration, legal, fees, and contingency.

[b] The CH2M Hill report listed only the total cost for 1995 O & M. The cost was broken down into component costs using the ratio from the 1985 O & M costs.

TABLE 14. SERVICE-AREA POPULATION, WASTEWATER FLOW, AND CAPITAL AND OPERATING COSTS FOR THE REGIONAL CONVEYANCE AND TREATMENT SYSTEM

	Population		Flow (mgd)		Capital Cost ($million)			Operating Cost[a] ($million)	
	1985	1995	1985	1995	Treatment Plant	Interceptors	Collectors	1985	1995
Mill Creek Residential	86,500	134,500	9.1	14.1	30	12	112	1.2	1.5
Mill Creek Industrial[b]	145,400	226,300	15.3	23.8	50	8	---	1.1	1.7
Mill Creek Total	231,900	360,800	24.4	37.9	80	20	---	2.5	3.5
Pond Creek[c]	123,800	123,800	13.0	13.0	28	--	---	1.3	1.1
Total	355,700	484,600	37.4	50.9	108	--	---	3.0	4.0

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[a] Operating cost for Mill Creek residential includes treatment plant, interceptors, and collectors; cost for Mill Creek industrial includes treatment plant and interceptors only; and cost for Pond Creek is for treatment plant only.

[b] Industrial equivalent population based on 36 persons per acre of industrially zoned land.

[c] Includes Shively and Morris Forman Diversion Area.

1. The planning period is 1985 to 1995.
2. All construction necessary for the wastewater treatment plants (the regional plant or the small plants) and all conversions of the present population to an on-site alternative will occur in 1985. Construction of collector sewers and installation of on-site systems for the future population will occur in 1990, the mid-year of the planning period.
3. Annual operating costs increase in a linear fashion between 1985 and 1995.
4. The interest rate is 7-1/8%, as specified in the U.S. EPA Program Requirements Memorandum PRM-80-1. The present worth factors calculated from this rate are shown in Table 15.
5. The salvage value of capital projects depreciates linearly over the expected life of the project; the value of land, however, does not depreciate. The depreciation schedules and salvage-value factors are given in Table 15.
6. Costs incurred in the past are "sunken costs" and are not included in the present worth analysis; existing structures and equipment have no salvage value. There is no need to include any of these--such as debt service on an existing treatment plant--because they are the same for all alternatives, and, therefore, do not affect the relative costs of the alternatives.

The calculation for alternative 4b in subarea 22 is shown in Table 16 as an example of the process. The present worth and annual equivalent cost of each alternative for the entire study area are listed in Table 17, along with several other measures of cost. It should be emphasized that none of these measures represents a true "user charge," because no federal funding has been assumed, no capital-bond service has been included, and the figures are based only on preliminary design. Once an alternative has been selected, it can be designed in more detail, and the user charge can be calculated.

Many of the existing on-site systems will reach 40-50 years of age during the planning period; if these systems are going to be used as the future treatment method, they will have to be replaced. The life expectancy of the septic tank and seepage pit was assumed to be 40 years, and the number of systems that would need replacement through the year 2000 was estimated from census records on the number of households in the area (U.S. Bureau of the Census 1972).

TABLE 15. FACTORS USED IN PRESENT WORTH CALCULATIONS

PRESENT WORTH FACTORS (i=0.07125)

1.	**Single-payment present worth factor**	
	a. 1985, n=10	0.5024
	b. 1990, n=5	0.7088
2.	Uniform-series present worth factor, n=10	6.9832
3.	Gradient present worth factor, n=10	27.50
4.	Capital recovery factory, n=10	0.1432

SALVAGE VALUE FACTORS

		Estimated Lifetime (years)	Salvage Value Factor For Construction In	
			1985	1990
1.	Septic tank system			
	a. Septic tank (1/3 system cost)	40	0.75	0.875
	b. Seepage pit (2/3 system cost)	20	0.5	0.75
2.	Aerobic tank and seepage pit	20	0.5	0.75
3.	Composting toilet	20	0.5	0.75
4.	Wastewater treatment plant			
	a. Equipment (1/2 plant cost)	20	0.5	0.75
	b. Structures (1/2 plant cost)	40	0.75	0.875
	c. Spray irrigation facility	20	0.5	0.75
5.	Conveyance system	50	0.8	0.9
6.	Land	--	1.0	1.0

TABLE 16. PRESENT WORTH CALCULATION FOR ALTERNATIVE 4B IN SUBAREA 22 (In Thousands of 1979 Dollars)

Line	Unit	Calculation (1)	Areas Presently on Septic Tanks (2)	Future Growth on Alternative Toilets (3)	Expanded Small Treatment Plants With:		
					Surface Water Discharge (4)	Subsurface Discharge (5)	Land Application (6)
	CAPITAL COST						
	Cost in 1979						
	Septic tank/aerobic tank	1/3 system cost	170(a)	910			
	Seepage pit	2/3 system cost	0	1,800		2,100	
	Composting toilet		720	2,600			
	Conveyance system				1,600	1,600	1,600
	WWTP equipment	1/2 WWTP cost			2,500	840	1,200
	WWTP structures	1/2 WWTP cost			2,500	840	1,200
	Spray irrigation						5,800
	Land						1,300
	Total	Add columns 2 & 3 to 4, 5, & 6, respectively	–	–	12,800	11,600	17,300
	Present Worth	Multiply cost in 1979 $ times PW factor:					
	Septic tank/aerobic tank	1.0 for columns 2, 4, 5, & 6; 0.7088 for	170(a)	640			
	Seepage pit	column 3.	0	1,300		2,100	
	Composting toilet		720	1,800			
	Conveyance system				1,600	1,600	1,600
	WWTP equipment				2,500	840	1,200
	WWTP structures				2,500	840	1,200
	Spray irrigation						5,800
	Land						1,300
1	Total	Add columns 2 & 3 to 4, 5, & 6, respectively	–	–	11,200	10,000	15,700
	Salvage Value	Multiply cost in 1979 $ times 1985 SV					
	Septic tank/aerobic tank	factor (Table 10) for columns 2, 4, 5, & 6,	84(a)	800			
	Seepage pit	and times 1990 SV factor for column 3.	0	1,400		1,000	
	Composting toilet		360	2,000			
	Conveyance system				1,300	1,300	1,300
	WWTP equipment				1,200	420	600
	WWTP structures				1,900	630	900
	Spray irrigation						2,900
	Land						1,300
2	Total	Add columns 2 & 3 to 4, 5, & 6, respectively	–	–	9,000	8,000	11,600
3	Present Worth of Salvage Value	0.5024 x line 2	–	–	4,500	4,000	5,800
4	Net Present Worth of Capital Cost	Line 1 - line 3	–	–	6,700	6,000	9,900
	OPERATING COST						
5	1986 Operating Cost		–	–	200	170	200
6	1995 Operating Cost		–	–	450	430	490
7	Operating Cost Gradient	0.1(line 6 - line 5)	–	–	25	26	29
8	Present Worth of 1986 Cost	6.9832 x line 5	–	–	1,400	1,200	1,400
9	Present Worth of Gradient	27.50 x line 7	–	–	690	720	800
10	Net Present Worth of Operating Cost	line 8 + line 9	–	–	2,100	1,900	2,200
11	TOTAL PRESENT WORTH	line 4 + line 10	–	–	8,800	7,900	12,100
	ANNUAL EQUIVALENT COST	0.1432 x line 11	–	–	1,300	1,200	1,700

Note: A blank space indicates that there is no cost associated with that cell. A dash indicates that the cost for that cell has been included in the costs of columns 4, 5, and 6 on the same line.

(a) Aerobic tanks for commercial units.

TABLE 17. PRESENT WORTH AND OTHER MEASURES OF COST OF THE ALTERNATIVES

Alternative	Capital Cost ($million)	Average Annual Operating Cost ($million)	Present Worth ($million)	Annual Equivalent Cost ($million)	Annual Equivalent Cost Per Thousand Gallons ($)
1. Septic tanks	39	1.4	25	3.6	0.85
2a. Septic tanks and existing small WWTPs with:					
Surface discharge	41	1.9	29	4.2	0.99
Subsurface discharge	39	1.7	27	3.9	0.92
Land application	53	2.0	39	5.6	1.32
2b. Septic tanks and expanded small WWTPs with:					
Surface discharge	52	1.9	36	5.1	1.20
Subsurface discharge	46	1.7	31	4.5	1.06
Land application	72	2.0	50	7.2	1.70
3. Alternative toilets	106	5.0	90	12.8	3.0
4a. Alternative toilets and existing small WWTPs with:					
Surface discharge	101	4.9	85	12.2	2.9
Subsurface discharge	99	4.8	83	11.9	2.8
Land application	113	5.0	94	13.5	3.2
4b. Alternative toilets and expanded small WWTPs with:					
Surface discharge	106	4.8	91	13.0	3.1
Subsurface discharge	100	4.6	87	12.5	2.9
Land application	125	4.9	106	15.2	3.6
6. Regional sewerage and WWTP	154	1.4	90	12.8	3.0
7a. Limited regional system with some existing and new WWTPs	105	2.1	50	7.2	1.70
7b. Limited regional system with some existing small WWTPs and septic tanks for future DU	50	1.5	32	4.6	1.09
7c. Limited regional system with some existing WWTPs	79	1.5	43	6.2	1.46
8. First phase of 201 regional system	80	1.5	45	6.4	1.51
9. No action	97	2.5	47	6.8	1.60

To be consistent with the other capital projects, all the replacements were assumed to occur in 5-year increments:

	Units Needing Replacement	Capital Cost
1985	970	$ 1,700,000
1990	3,200	5,700,000
1995	5,400	9,700,000
2000	5,400	9,700,000

For the EIS planning period, only the replacements in 1985 and 1990 affect the present worth. For those two years, the present worth of replacement--not including operating costs, which have already been accounted for in the previously calculated present worths--is $3,000,000. All of the alternatives except the regional system (alternative 6) continue the use of present on-site systems, so the present worth of replacement was included in the total present worths (Table 17) of all alternatives except 6. This procedure slightly over-estimates the replacement cost in alternatives 2b and 4b where some of those on-site systems will be abandoned in favor of a small treatment plant. The number of houses affected by this cannot be estimated from the census records, but it is small compared to the total number of houses in the study area. This analysis could not be done on a subarea basis, because the census information does not provide that level of detail.

In terms of regional present worth, the alternatives and subalternatives fall into seven levels of cost:

Approx. Cost ($ million)		Alternative
25	1.	Septic tanks serving all units
	2a.	Septic tanks and existing small plants with subsurface discharge
30	2a.	Septic tanks and existing small treatment plants with discharge to surface waters
	2b.	Septic tanks and expanded small plants with subsurface discharge
	7b.	Limited regional system and septic tanks
35	2b.	Septic tank and expanded small plants with discharge to surface waters
40	2a.	Septic tanks and existing small plants with land application of effluent
	7c.	Limited regional system with capacity for future population
	8.	First phase of the regional system

Approx. Cost ($ million)	Alternative
50	9. No federal action
	2b. Septic tanks and expanded small plants with land application of effluent
	7a. Limited regional system and small plants with discharge to surface waters
90	4a. Alternative toilets and existing small plants with subsurface discharge
	4a. Alternative toilets and existing small plants with discharge to surface waters
	4b. Alternative toilets and expanded small plants with subsurface discharge
	6. Regional conveyance and treatment
	3. Alternative toilets serving all units
	4b. Alternative toilets and expanded small plants with discharge to surface waters
	4a. Alternative toilets and existing small plants with land application of effluent
100	4b. Alternative toilets and expanded small plants with land application of effluent

In most of the subareas, the alternatives fall into roughly the same levels of cost as in the study area as a whole. The exceptions are the subareas that already have large sewered areas, where the great expense of the collection system has already been met. For example, subarea 58 (Valley Village subdivision) is completely served by a small treatment plant, and the alternatives that connect the system to the regional system or the limited regional system have a lower present worth than any other alternatives. Even though interceptor VV-1 would have to be built to connect 58 to the West County Treatment Plant, the regional alternatives have lower present worths, because the collection system is already in the ground and the regional plant is cheaper to operate, on a per unit basis, than the small plant. In subarea 49, on the other hand, the present worth of keeping the existing small plant, with either a surface water or subsurface discharge, is lower than either of the regional systems or the all-septic-tank alternative. Almost all of the existing population in 49 is currently on the Forest Hills sewerage system, so the cost of converting to septic tanks is relatively high; but there is also a large undeveloped area that would require extensive sewering for future connection to a regional system, so the cost of alternatives 6 and 7a is even higher. Subarea 36 is the only subarea besides 58 where the full regional system has the lowest present worth. This area comprises commercial establishments almost entirely and the cost of converting these units to individual aerobic tanks is greater than the cost of sewering. In subareas 28, 53, and 55, alternative 7b has the lowest present worth. Portions of these subareas are currently sewered, but larger portions are unsewered. Alternative 7b realizes the economy-of-scale of the limited regional system for the currently sewered areas without causing the expense of connecting existing septic tanks to a collector system or of building a sewerage system on currently undeveloped land.

At this point the regional system cannot be compared directly with the small treatment plants, because the present worths of the alternatives with the small plants are biased by the inclusion of less-expensive on-site treatment systems for some of the population. If the regional system is eventually selected as the most acceptable alternative, then the question of continuing the use of each small plant or connecting it to the regional system can be examined more closely. Preliminarily, the fact that in subarea 58, which is entirely sewered, the regional system has a lower present worth than any of the alternatives involving the continued use of the small treatment plant may indicate the ultimate result of the closer analysis.

A special alternative was considered for Subarea 22, where four existing small treatment plants (Cardinal Mobile Home Park, Silver Palms Swim Club, Fordhaven subdivision, West Springfield subdivision) are located in close proximity to one another. Under alternatives 2b and 4b, each plant's service area would be expanded to encompass all land draining to the plant. This expansion would cause extensive overlapping of the service areas of the four plants. The concept of combining the four existing plants into one plant was examined to determine if an economic benefit could be derived by such consolidation. The results of the cost analysis indicate that a 10 to 25 percent savings in present worth could be realized by combining flows:

	Present Worth ($ million)	
Subalternative	Combined Plant	Separate Plants
Advanced wastewater treatment with discharge to surface waters	2.2	2.9
Primary treatment with subsurface discharge	2.3	2.6
Secondary treatment with land application of effluent	5.5	6.1

It is emphasized that consolidation would be beneficial only under alternatives involving expansion of treatment plant service areas (2b and 4b).

As a result of this cost analysis, alternatives 3, 4, and 5 were not evaluated further. Alternative 5 was shown to be uneconomical in comparison to alternative 6, which accomplishes the same objective, namely, sewering of the entire study area. Alternatives 3 and 4 are not feasible because of their high cost, and implementation problems of using alternative toilets in a densely populated area.

3.4.2 Technical Feasibility

The technical feasibility of the remaining wastewater management alternatives (alternatives 2, 6, 7, 8, and 9) has been evaluated in terms of the installation or construction and the operation and maintenance characteristics of the alternative. Of course, with such a wide variety of alternatives it is difficult to assess the merits of each in relation to the others. There are, however, certain common parameters that may be evaluated for each alternative.

Construction

The feasibility of installing or constructing any of the alternatives depends on ease of installation or construction, availability of materials, and availability of manpower experienced in working with the alternative in question. None of the alternatives has any severe technical constraints in terms of installation or construction. All alternatives are not equally attractive form the standpoint of feasibility of construction. Septic tanks, sewers, and wastewater treatment plants are all fairly common construction projects, but each has special technical considerations that may affect its attractiveness in relation to the others.

Alternatives 6, 7, and 8 involve a collection system (of varying scope) with treatment at one central facility--the West County Wastewater Treatment Plant, a new installation located on a large tract of land near the Ohio River. In constructing a new treatment facility on a large tract of land, technical problems associated with modifying an existing facility do not arise. For example, under Alternatives 2 and 9, the existing wastewater treatment plants will either be modified, expanded, or replaced. Technical problems associated with these efforts may include maintaining flows during construction and, in some cases, limited availability of land. These problems can be overcome but often at a considerable increase in cost.

Several of the alternatives call for new houses to be placed on septic tanks with on-site disposal of effluent. From a technical standpoint, this is a relatively simple matter, if tests demonstrate that the land is suitable.

Operation and Maintenance

Operation and maintenance of the treatment alternatives will be discussed in terms of three characteristics: reliability, flexibility, and ease of operation and maintenance. Each of these aspects will be considered form the viewpoint of the homeowner, and where applicable, the public management agency.

Reliability

The reliability of a wastewater management system may be defined as a measurement of the ability of a system to perform its designated function without failure. Failure, in this situation, would be the inability to consistently achieve and maintain the effluent quality standards for which the system was designed. There are three reliability classes associated with treatment facilities (U.S. EPA 1974):

1. Reliability Class I--Treatment facilities that discharge into navigable waters that could be permanently or unacceptably damaged in only a few hours by poor quality effluent. Requirements for Class I facilities are some type of surge-control device, back-up units for all major pieces of equipment, and standby power.

2. Reliability Class II--Treatment facilities that discharge into navigable waters that would be permanently or unacceptably damaged by long-term (several days) effluent-quality degradations. For secondary treatment systems, requirements for Class II facilities are very similar to those for Class I facilities.

3. Reliability Class III--All other treatment facilities not covered under Class I and Class II. Some standby power is required, as are certain basic redundancy requirements, such as extra pumps and blowers.

Although the use of septic tanks in the Mill Creek area has not resulted in the widespread occurrence of failing septic tanks, the EIS Groundwater Program has indicated that the use of septic tanks is influencing groundwater quality, and as a result, the groundwater is generally not suitable for use as an untreated drinking water source. The septic tank systems are reliable because they function well and can be expected to function well in the future. Reliability of septic tanks is somewhat dependent on the homeowner, many of whom do not pump out a septic tank until a problem occurs. To maintain the septic tank at optimum operating conditions, it should be pumped out every two to five years. The number of failures in the Mill Creek area has been remarkably small, especially in light of the number of systems and the length of time these systems have been operating. These systems would be considered to be very reliable.

A large treatment facility such as the West County Treatment Plant is designed to Reliability Class I criteria and staffed 24 hours per day. Thus, the plant would be largely unaffected by power outages and any emergencies that occur would be handled immediately by operating personnel.

Most of the existing package treatment plants do not conform to the reliability guidelines because they do not have a source of standby power and a redundancy of certain key units. The costs included in Section 3.4.1 for new small-area treatment plants include emergency standby generators and sufficient redundancy to allow each small plant to be classified as a Realiability Class III facility.

System alternatives 7 and 8 have reliability similar to the ones discussed above. Similar to alternative 6, they offer the reliability of a regional plant and similar to alternative 1, they contain a large number of reliable septic tanks. The small-area treatment plants included in these alternatives are considerably less reliable.

Wastewater management under the no-action alternative will be carried out almost entirely by homewoners and private WWTP owners. Thus, the responsibility for proper operation of disposal systems will be distrubuted over thousands of individuals. This diffusion will probably result in a level of system reliability similar to the current level of system reliability. Enforcement and monitoring will continue to be the responsibility of the Health Department, and correction of problems will require cooperation of owners. System reliability problems may be aggravated by the advancing age of many of the on-site units and small treatment plants.

Flexibility

Flexibility of a wastewater management system is evaluated in terms of its capability to serve future population needs; its ability to comply, or to be brought into compliance, with possible future effluent quality requirements; and its ability to deal with unusual circumstances, such as power outages and equipment failure or replacement needs.

In one sense, the Mill Creek area centralized systems offer technical flexibility similar to on-site systems in providing wastewater management facilities for future population, since on-site systems are generally not constrained by soil and geologic conditions in this area. On-site systems, however, may restrict potential growth in this area due to limitations imposed by the Jefferson County Health Department. On-site systems might possess an advantage to the individual future homeowner since residential development would not be constrained by the construction of sewer systems. Thus, from the viewpoint of the individual small developer or homeowner, the on-site system provides great flexibility. Of course, this flexibility would be available only if on-site systems were to be deemed acceptable wastewater management systems by state and local regulatory bodies.

Two aspects of on-site systems would detract form their flexibility in providing facilities for future population: they have been shown to be unsuitable for commercial development, and they could hamper residential development at higher densities. However, the availability of existing lines (Black Pond Interceptor) would tend to minimize the constraint to higher density development posed by on-site systems.

A centralized wastewater management system will nearly always provide maximum flexibility in dealing with future changes in effluent quality requirements and unusual circumstances. System upgrading at a larger, central facility would be favored by economies of scale when compared to upgrading of numerous smaller systems. Treatment unit redundancy in a larger facility will provide for flexibility in dealing with equipment shutdown for maintenance or repair.

Ease of Operation and Maintenance

The divergent characteristics of the system alternatives make direct comparisons of ease of operation and maintenance difficult. Obviously, a wastewater treatment plant and sewer system require more extensive operation and maintenance effort than a single on-site disposal system. The individual homeowner, however, has more direct responsibility in the maintenance of an on-site system than he has for a centralized system. This responsibility could be relieved (and the reliability of system alternatives involving on-site systems could be enhanced) by operation and maintenance of private on-site systems by a public agency. It should be noted, however, that it would probably be less cumbersome for the public agency to operate and maintain a centralized sewerage system than the on-site systems of over 20,000 customers.

Similary, it would be less cumbersome for a public agency to operate and maintain a single treatment plant than it would be to operate several small plants. Concentration of management responsibility at a single facility would allow the public agency to train and effectively utilize specialized operation and manintenance personnel. Such specialization would be economically unrealistic in smaller plants.

In terms of overall feasibility, alternatives without small treatment plants have fewer potential technical problems associated with them than have the other alternatives; therefore, they can be considered more technically feasible. Since System Alternative 6 involves one new regional treatment facility, there is less liklihood of operational problems than with many smaller, older plants.

3.4.3 Implementation

Public Acceptance

Public acceptance of wastewater management alternatives is expected to be closely related to the costs to homeowners, with public resistance increasing with an alternative's cost. Inconvenience to homeowners will also be a factor in public acceptance. Owners of single-family dwelling units served by on-site systems have been represented throughout the Mill Creek EIS public participation program. Homeowner attitudes may be fairly well established, if the participants in the public participation program are assumed to constitute an adequate sample of all homeowners. This assumption, however, has not been tested.

Public groups other than owners of single-family dwellings have not been active in registering opinions concerning Mill Creek wastewater management alternatives. The probable reactions of specific groups affected by each alternative may be suggested by examining the particular interests of each group.

Commercial owners, including apartment and office building owners, will be likely to favor alternatives that remove the responsibility for wastewater disposal from them and place it with a public agency. Cost will probably be a secondary consideration to relief from wastewater treatment problems.

Owners of existing small treatment plants will consider the alternatives in two ways. First, these owners are likely to favor alternatives to upgrading their plants to meet effluent standards. Second, this favoring of certain alternatives will be tempered by an interest in compensation for abandonment of the small treatment plants. Compensation may become less important to private owners of sewerage systems as the needs for system upgrading and replacement arise. Many plants constructed in the early 1970s will be approaching the end of their effective structural lives by the early to middle 1990s. Thus, private owners may find public appropriation attractive.

Landowners with interest in residential, commercial, or industrial development will favor the alternative that most greatly facilitates such development and allows the greatest flexibility in type and density of development.

Public Agency Actions

Kentucky Department for Natural Resources and Environmental Protection (KDNREP)

KDNREP was requested to supply the current policy to be followed in designating use of the Mill Creek aquifer and in developing groundwater quality standards. The response by Secretary Swigart (1980) provided the following general guidance:

1. Kentucky is in the process of developing groundwater quality standards. Promulgation is projected for early summer, 1981.
2. The groundwater standards, in conjunction with aquifer-use designations, will be used to control the impact of waste disposal on groundwater.
3. It is likely that construction requirements for on-site wastewater disposal systems will be revised following promulgation of groundwater quality standards. It is possible that soil or geologic characteristics would prevent the use of on-site systems in certain areas of the state.
4. Until groundwater standards are put into effect, procedures to control waste disposal practices will be developed on a case-by-case basis.

Louisville and Jeffersor County Department of Public Health (L/JCDPH)

Regulatory activity by the Health Department is an essential element of all system alternatives except Number 6, the regional system. Specific action by the Board of Health would be necessary for implementation of certain features of several of the system alternatives. These actions are summarized in Table 18 which is not exhaustive.

Metropolitan Sewer District (MSD)

Participation by MSD in system alternatives other than the regional and limited-action systems would probably be limited to acquisition, development, and operation of existing small treatment plants under alternative 2b. Involvement in this alternative would not require specific new authority for MSD; the agency operates several small plants in Jefferson County at this time. It should be noted, however, that MSD has not expressed interest in assuming operating responsibilities for other small plants in the study area.

Local Implications

The acceptability of the various system alternatives to local agencies and government (L/JCDPH, MSD, and Jefferson County) may be surmised by analyzing past actions and present policies of each entity. The proper context for an understanding of probable local government and agency reaction to the system alternatives may be developed by reviewing the recent history of sewerage expansion into Jefferson County.

The proposed financing arrangement for MSD's expansion outside the Louisville city limits was described in the 201 Plan.. The MSD expansion was to occur in several phases, with revenues from one phase providing partial funding of subsequent phases. The Mill Creek area was designateted for Phase 1 sewering. This designation was fairly logical from a cash-flow viewpoint: The Mill Creek area would provide a large, dense customer base and, thus, expansion capital for Phase 2. Jefferson County provided about $25 million to MSD to carry out design and construction of the major interceptor lines in the Mill Creek area. A portion of the $25 million was used to construct the Black Pond interceptor and force main, as well as the other existing Mill

TABLE 18. SUMMARY OF HEALTH DEPARTMENT ACTIONS NECESSARY FOR IMPLEMENTATION OF THE ALTERNATIVES

Alternative		Health Department Action
1	1.	Board of Health would have to adjust policy on 5-acre on-site systems for Mill Creek area.
	2.	Mechanism for forcing presently sewered households to install on-site systems would have to be developed. Power for enforcing such action is extremely uncertain; legal challenge probably inevitable.
	3.	Department would probably have to expand regulatory staff.
2 a,b	1.	See comment 1 for alternative 1.
	2.	Under 2b, mechanism would have to be established to serve nonsubscribed population with expanded existing WWTPs. This mechanism would probably require public ownership of WWTPs.
	3.	For subsurface and land discharge options, regulations, design criteria, and operating criteria would have to be developed.
5	1.	No specific action necessary. New small-area WWTPs will require permitting under NPDES.
	2.	DPH will have greatly expanded monitoring and enforcement function. Will probably require substantial staff increase to handle expanded jurisdiction.
6		No specific action necessary. County Sanitary Code empowers Department to require connection to public sewers, when available.
7 a,b,c	1.	For 7a, see comment 2 for alternative 5.
	2.	For 7b, see comment 1 for alternative 1.
	3.	For 7c, see comment 1 for alternative 1 and comment for alternative 6.
8		See comment 3 for alternative 7.
9		See comments 1 and 2 for alternative 5.

Creek sewers. Another portion of the funds were used by MSD to design virtually all the collector sewer systems for the Mill Creek area.

By mid-1977, MSD was moving steadily toward constructing the regional wastewater management system in the Mill Creek area. The EPA Notice of Intent to Prepare an EIS caused MSD to shift emphasis to the Pond Creek system. This shift, made for the sake of expediency and to preserve expansion "momentum," served to diffuse the effect of the $25 million County contribution to the expansion effort. Today, pieces of both the Mill Creek and the Pond Creek systems have been built, but neither system is ready to begin generating revenues to fuel continued expansion.

A fundamental issue now confronts MSD: the right of the agency to assess property owners for their proportionate share of collection system costs. MSD and the Health Department have proceeded with public sewer projects since the early 1950s on the premise that public sewers provide benefits to affected properties and, thus, may be assessed to those properties. The basis for the benefit has been the relief and removal from service of on-site systems and small package treatment plants. This basis for benefit to properties has been recently reiterated by MSD Board members as well as by Health Department officials. MSD is conserned that a selected plan for this EIS comprising current or future population utilizing on-site disposal systems will cause problems in the agency's exercising of its right to assess. In MSD's view, the aura of legitimacy provided on-site systems could bring litigation in each future collector sewer assessment endeavor, as property owners seek to maintain their on-site systems.

MSD's concern for future litigation during assessment proceedings could be overstated, and future sewerage expansion into Jefferson County probably would not be hampered by a carefully stated EPA decision regarding the Mill Creek study area. Nevertheless, future expansion will depend on capital to be raised through revenue and assessment bond issues, and the saleability of those bonds will depend heavily on the perception by bond buyers of MSD's ability to collect assessments and generate revenues. In MSD's view, the appearanceof potential assessment problems may have severe impacts on the agency's ability to raise expansion capital. Concern for MSD's ability to sell bonds prompted MSD to project this response by the agency to an EIS-selected plan that maintains on-site systems: For the foreseeable future, MSD would not proceed with sewer expansion projects anywhere in Jefferson County.

The implications of a halt to expansion by MSD are manifold. The primary impact would, of course, be the absence of a program of relief of public health and environmental problem areas, such as residential developments with failing on-site sytems and streams affected by inadequately treated wastewater discharges. Relief of on-site-system failure areas in Pond Creek, for instance, would probably be carried out by a proliferation of small-area wastewater management systems with discharges to Pond Creek. Sanctioning additional discharges to Pond Creek would place Jefferson County at odds with its commitment to the U.S. Army Corps of Engineers to improve the stream water quality for the benefit of the proposed Pond Creek--Knob Creek recreational impoundment. Finally, cessation of expansion by MSD would cause the County to consider $25 million in general obligation bond proceeds to have been spent for no benefit.

Other Considerations

The concept of public ownership of small treatment plants under certain EIS alternatives was presented earlier. Indeed, alternative 2b would appear to require public operation of small treatment systems. Public ownership would have several advantages, including:

1. Operation and reliability would be enhanced by provision of a trained operator corps for small treatment plant management.
2. User charges would probably decrease, since higher unit costs for operating and maintaining the small plants would be distributed across a large customer base.

The appropriate agency for public ownership is MSD. Whether MSD would accept control of small plants under alternative 2 is a question that has not been presented to the agency.

The concept of public ownership of on-site disposal systems, though relatively new, has been applied in some areas of the nation. Under this concept, on-site system management districts are established and operated by a public agency. The public agency may own the on-site disposal system and is granted an easement by each property owner to allow agency personnel access to the disposal units for maintenance and inspection. Public ownership or control of on-site systems may offer several benefits, including:

1. Initial upgrading of existing units may be carried out with funding under the EPA construction grants program.
2. The public agency carries out a regular inspection and maintenance program, preventing system failures.

The major disadvantage of this concept could be cost. In order for on-site systems to be EPA grant eligible, EPA regulations require that unlimited access to each system be ensured at all reasonable times. Such access may be necessary for inspection, monitoring, construction, maintenance, operation, rehabilitation, or replacement, and it may be in the form of an easement or covenant running with the land. Acquisition of on-site system and rights-of-way may therefore entail legal and engineering fees in the neighborhood of $1,500 to $2,500 per property. Further, the public agency responsible for operation of the management districts for an area such as Mill Creek would require operating funds in the range of $300,000 to $500,000 per year.

The costs of public acquisition and operation of small treatment plants and on-site sytems are fairly obvious, though somewhat difficult to quantify. It should be noted, however, that the job of monitoring and regulating either type of system will fall entirely on the Health Department under the existing local arrangement in Jefferson County.

3.4.4 Riverport Alternatives

Alternatives Description

As noted in Section 3.3.3, there are three general alternatives for management of industrial wastewaters form the Riverport complex. Industrial wastewaters from the Riverport complex. Industrial wastewaters may be pretreated, if necessary, and

1. Collected and conveyed to the proposed MSD interceptor sewer system,
2. Collected and treated at a central Riverport facility, or
3. Handled and disposed of by each industry.

Since it is not yet known what type or how many industries will be developed at Riverport, the evaluation of alternative 3 is not possible at this time.

Alternative 1 components include collector sewers, to carry the wastewater from individual industries to the interceptor sewers, which will convey the wastewater to the proposed West County regional treatment plant. Alternative 2 components include collector sewer and a central industrial wastewater treatment facility with a discharge to the Ohio River. The basis of design for the industrial treatment facility has been assumed to be similar to that for the West County Wastewater Treatment Plant.

Present Worth Analysis

For the purposes of cost comparison, it is not necessary to include prices of components that are common to both alternatives. The collection system would be the same in each alternative and the cost has, therefore, not been included in this present worth analysis.

Pretreatment is required where wastewater from an industry has characteristics that would diminish the effectiveness of a wastewater treatment plant. Since both WWTP alternatives invlove the same treatment process, pretreatment would be applicable to certain industrial wastes conveyed to either treatment plant. Therefore, the cost of pretreatment has not been included in the present worth analysis.

The interceptor system for the regional alternative comprises the MSD interceptors MC-3, MC-2(b), MC-2(a), MC-1(b), and MC-1(a) (Figure 1). MC-1(b) and MC-1(a) have been consturcted and are not included in present worth analysis. MC-3, MC-2(b), and MC-2(a) cover the distance form north to south along the eastern edge or Riverport. The design flow for these interceptor segments was derived from the 1995 projections of total flows, developed by MSD. The 1995 design capacity for the Riverport central industrial wastewater treatment facility was established at 8.6 million gallons per day (mgd), based on MSD industrial flow projections. The estimated capital cost of the central facility was based on data collected by Gannett Fleming Corddry and Carpenter, Inc., from similar plants and adjusted to 1979 prices. The capital cost of treatment capacity for Riverport wastewater at the West County regional plant was determined by the proportion of Riverport flows to the 50-mgd design flow. Costs for operating and maintaining each facility were estimated from actual records of treatment costs at treatment plants of similar size.

The results of the present worth anlaysis reflect in part the economies of scale for a large treatment plant compared to a smaller treatment plant:

	Riverport Central Facility	Regional System
Capital Cost		
1985	$11,500,000	$8,700,000
Operating Cost		
1986	600,000	360,000
1995	940,000	610,000
Present Worth	$13,000,000	$9,200,000

Technical Feasibility of Riverport Alternatives

Either alternative for collection and treatment of Riverport industrial wastewater is technically feasible. Both alternatives would involve essentially the same construction activities, and both alternatives are based on traditional technology. However, an analysis of the feasibility of industrial wastewater treatment in a private or public system should include such consideration as:

1. Certain industrial wastes require lesser or greater levels of treatment. Such disparities have been accounted for, to an extent, in this analysis by assuming common pretreatment trains under both alternatives.
2. Certain industrial wastes may be combined at a central facility in a manner that achieves partial neutralization of wastes. Such beneficial mixing of wastes could not be carried out at a municipal treatment plant.
3. Central treatment of wastes form several specific industries could be more economical than pretreatment at each industry followed by conveyance to a municipal treatment plant.
4. Periodic slug releases from industries, even with pretreatment, could affect the operations of either system. A private plant may be designed to handle emergency flows from the industries in Riverport. The municipal plant would not have such capabilities, but it would offer more dilution, which may mitigate the effect of the slugs.

An additional point to consider in this evaluation is the requirement under the federal Clean Water Act that new industrial discharges conform to New Source Performance Standards (NSPS). Since the Commonwealth of Kentucky has notassumed NPDES permitting authority form EPA, National Environmental Policy Act (NEPA) regulations could require the preparation of an EIS in conjunction with the NPDES permit application. This requirement could extend by several years the timetable for implementing the industrial treatment facility option. Further, the Central Riverport treatment facility could possibly be construed by EPA to be a "new source" with each new industrial connection. If further NEPA compliance is necessary, such classification of the facility could lengthen the time to obtain an NPDES permit for new industries in the Riverport complex.

Evaluation of the effects of these subtleties on the cost-effectiveness of the Riverport alternatives must be deferred until specific industries are identified. Of course, the Mill Creek interceptor will not be economically feasible until a certain level of industrial subscription to the Riverport facility occurs. Thus, the decision as to the best alternative for Riverport should be separated from consideration of alternatives for residential population.

Environmental, Social, and Economic Impacts

The impacts of industrial development at Riverport are being evaluated by the U.S. Army Corps of Engineers in a separate EIS (May 1981). The wastewater management system determined to be most cost-effective for Riverport will be only one factor in the development of the industrial complex. The Louisville and Jefferson County Riverport Authority has already acquired title to land on which the park is to be established, and zoning will allow for industrial development. The most significant contribution to environmental impacts of the two wastewater management systems will pertain to timing of impacts. If the regional system is the selected EIS plan and construction proceeds quickly, then development of Riverport under the industrial treatment facility option may be delayed several years compared to development under the public system option. Thus, providing treatment of Riverport wastes at the West County Treatment Plant could impose environmental impacts somewhat earlier than the private option. Whether the extent of environmental impacts would differ under either alternative is impossible to determine.

The major environmental impacts of Riverport development will be those related to urbanization of presently undeveloped lands. One impact of industrial development in the Riverport area will be the loss of environmentally significant agricultural lands. Most of the environmentally significant agricultural land in the Mill Creek study area is located in the area to the west of Black Pond Creek. Approximately 1,100 acres of significant farmland are located within the boundaries of Riverport, and an additional 500 acres lie east of Riverport between Mill Creek and Pond Creek. This latter area could be served by the Pond Creek interceptor as well as the Mill Creek interceptor, so development in this area is not contingent upon construction of the Mill Creek interceptor. It is important to note that EPA's official policy is to avoid actions that would cause or facilitate the "irreversible conversion of significant agricultural land to uses which result in its loss as an environmental or essential food production resource" (September 8, 1978, memo from Douglas Costle to Assistant Administrators).

4. DRAFT EIS PREFERRED ALTERNATIVE

4.1 EPA's Decision

The action proposed by EPA for the Mill Creek EIS study area should be regarded in the light of several important factors:

1. The study area comprises a relatively small portion of the Jefferson County area not currently served by regional sewers.

2. EPA has recognized the crucial need for relief of unsewered areas in the Pond Creek watershed. EPA supports the construction of the West County wastewater treatment plant to service the Pond Creek watershed.

3. Wastewater management activities carried out in any part of Jefferson County should comprise a segment of a feasible, comprehensive program.

4. Unlike most of Jefferson County, subsurface conditions in the Mill Creek area allow most wastewater management needs in the area to be satisfied by on-site systems.

EPA has determined that the appropriate action for the Mill Creek area would be to alleviate the problems caused by malfunctioning commercial septic tank systems and small wastewater treatment plants by implementing Alternative 7b. Alternative 7b, the preferred alternative, is shown in Figure 14. This alternative proposes a limited sewering action that would serve the Dixie Highway Corridor and at least eighteen of twenty-six small package plants, while leaving the residential community on septic tanks. The remaining eight small plants could be dealt with in one of several ways, such as 1) upgrading to meet water quality requirements, 2) disposing of effluent to seepage pits, 3) conveying wastewater to the existing Black Pond Creek interceptor or 4) conveying wastewater to the proposed Dixie Highway Interceptor. Other small, existing treatment facilities with surface water discharges (seven plants in the 500 to 2,000 gallons per day range are operated in the study area) could be connected to either the existing Black Pond Creek sewer, to sewers to be constructed under Alternative 7b, or discharge to groundwater.

It is important to note that EPA's preliminary decision relates only to the wastewater management needs of the Mill Creek study area. Thus, the selected action represents a decision on federal funding for the area of greatest need for public sewering in the EIS area, that is, the Dixie Highway Corridor and the small wastewater treatment plants. Since this EIS is dealing only with the Mill Creek area, the environmental and public health needs of the area to be served by Alternative 7b, have not been compared to needs in other parts of Jefferson County, such as Pond Creek and North County. Wastewater management requirements in Mill Creek should now be addressed in the larger context of the entire County, through the 201 planning process.

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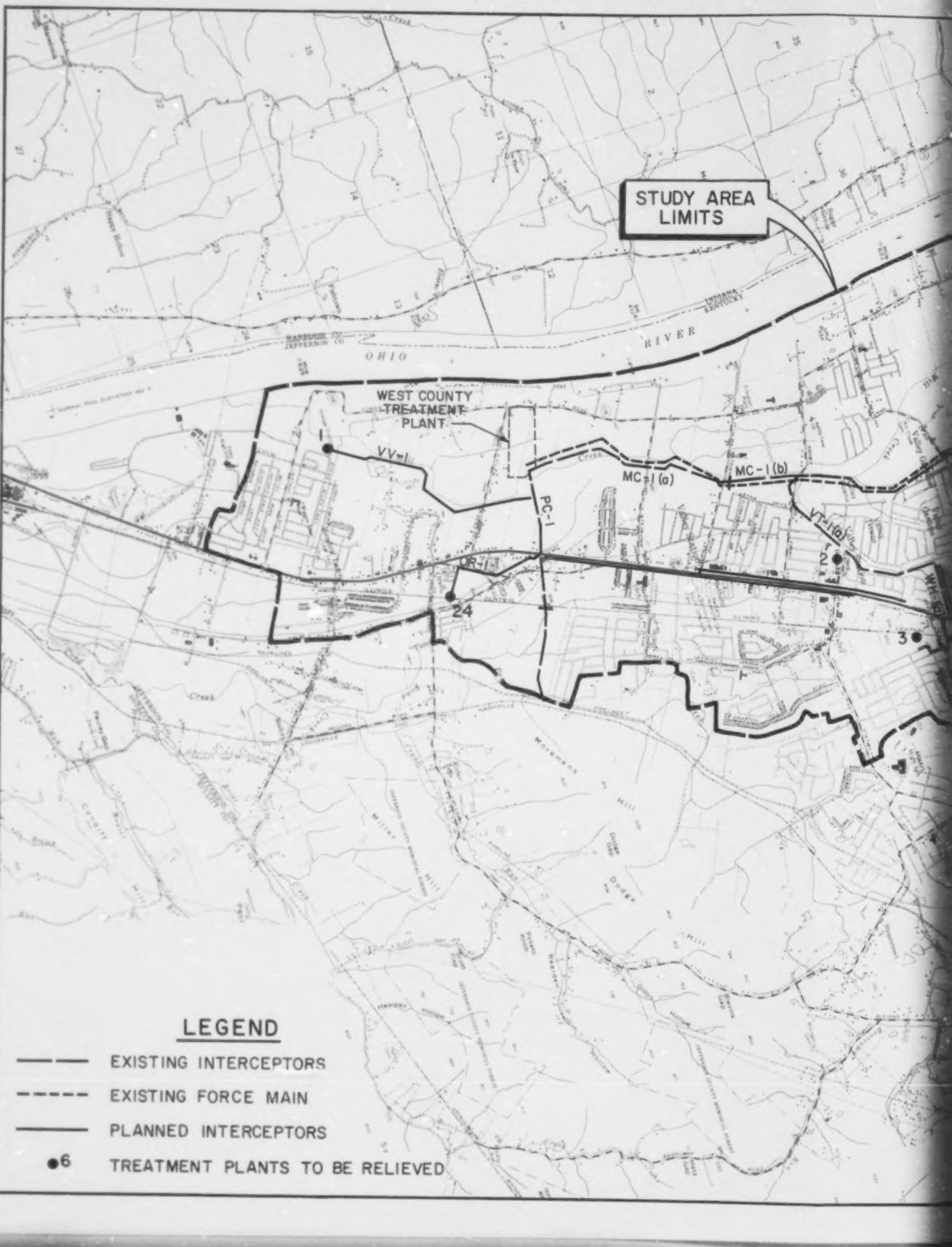
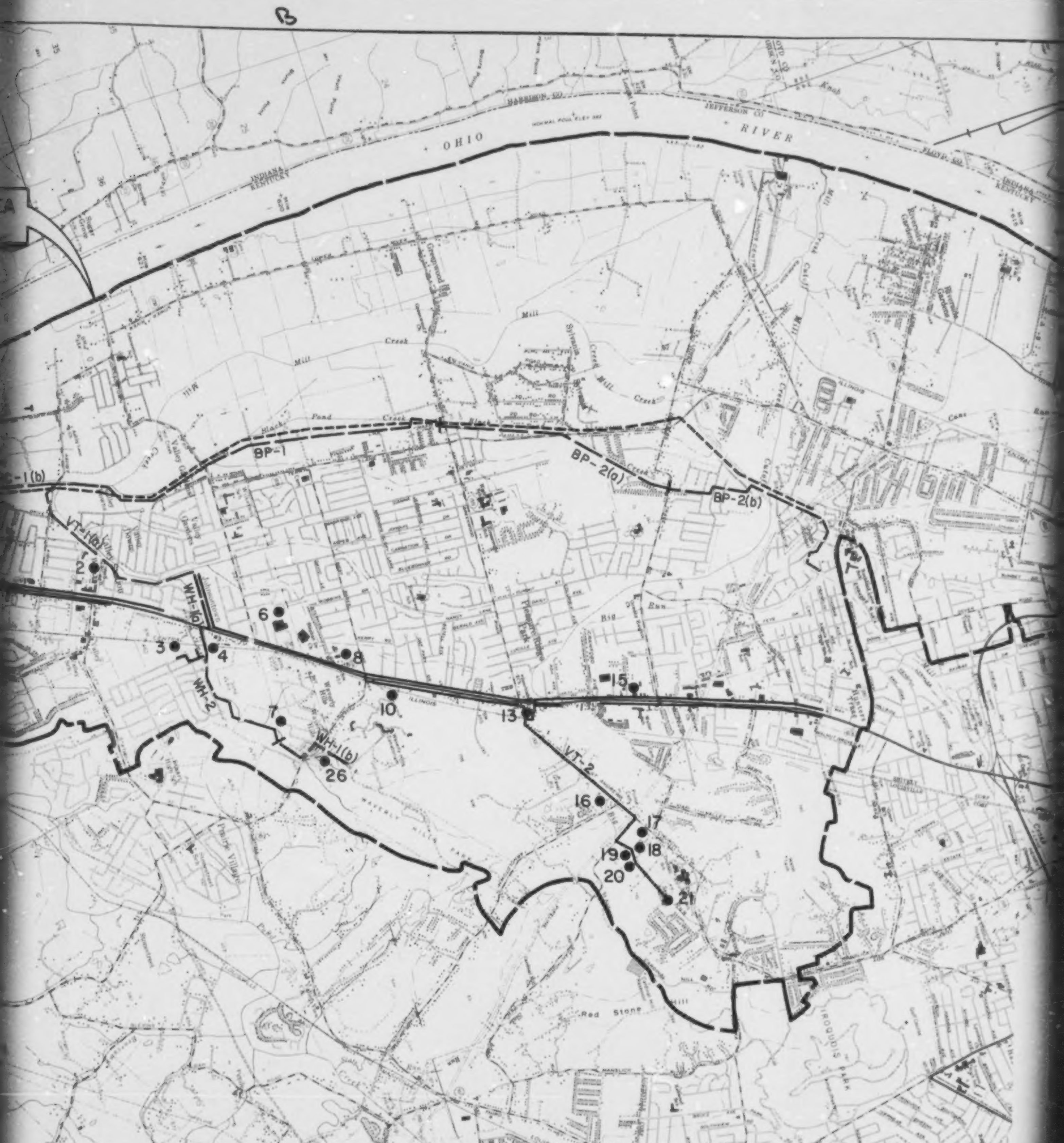

STUDY AREA LIMITS
INDIANA
KENTUCKY
HARRISON CO.
JEFFERSON CO.
OHIO
RIVER
WEST COUNTY TREATMENT PLANT
VV-1
PC-1
MC-1 (a)
MC-1 (b)
VT-1(a)
OR-1
2
3
24
Creek
Moremens
Hill
Miller
Hill
Dodge
Hill
LEGEND
EXISTING INTERCEPTORS
EXISTING FORCE MAIN
PLANNED INTERCEPTORS
●6 TREATMENT PLANTS TO BE RELIEVED


B
OHIO RIVER
INDIANA
KENTUCKY
HARRISON CO.
JEFFERSON CO.
FLOYD CO.
Knob
Mill Creek
Pond Creek
Big Run
Cane Run
Red Stone
Waverly Hills
ILLINOIS
IROQUOIS PARK
Prairie Village
BP-1
BP-2(a)
BP-2(b)
C-1(b)
VT-1(b)
VT-2
WH-1(b)
WH-1(b)
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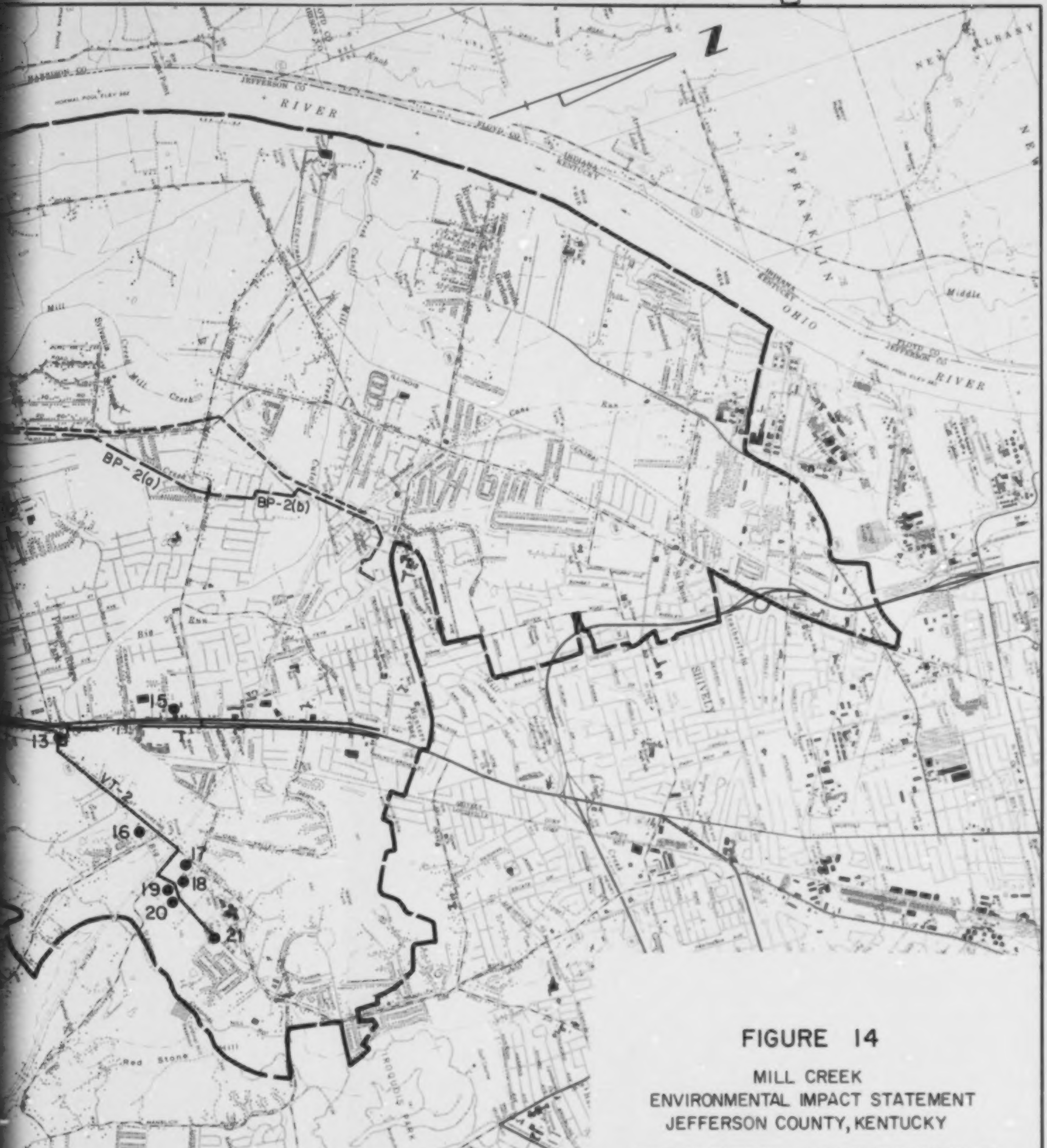

FIGURE 14

MILL CREEK
ENVIRONMENTAL IMPACT STATEMENT
JEFFERSON COUNTY, KENTUCKY

PREFERED ALTERNATIVE

4,000 FEET 0 4,000 8,000
1,200 METERS 0 1,200 2,400

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV ATLANTA, GEORGIA

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EPA recognizes that serving future population with on-site systems would not be consistent with existing Health Department septic tank regulations. In this regard, the Federal government is not attempting to preempt local decision-making. EPA supports the existing septic tank regulations and proposed regional system in the Pond Creek drainage area. The North Jefferson County study area is the subject of an ongoing EIS and decisions in North County will be made within the framework of that study. The Mill Creek Area Draft EIS preliminary decision should therefore be viewed as a decision that is specific to the Mill Creek EIS study area and the special circumstances of this area with no implications in other parts of Jefferson County.

Additionally, EPA is not seeking to limit the flexibility of local government in accommodating future development in the study area. It should be noted that, while on-site systems would not be consistent with certain types of residential and commercial development, substantial sewer capacity is available at this time in the Black Pond Creek interceptor. EPA's selected action does not preclude use of this existing sewer to serve future developments if locally determined to be appropriate.

4.2 Description of the Proposed Action

Alternative 7b makes use of three types of treatment systems: a regional system, on-site systems, and possibly a few small-area treatment plants. Existing unsewered commercial units not along the Dixie Highway corridor and existing unsewered residential units will continue the use of on-site systems or connect to existing interceptors. The eight small-area treatment plants (WWTPs) that serve schools have several options available including: 1) upgrading and surface water discharge, 2) disposal in seepage pits, 3) conveying wastewater to the existing Black Pond Interceptor, or 4) conveying wastewater to the proposed Dixie Highway Interceptor. The other 18 WWTPs and commercial units along the Dixie Highway corridor will be served by the limited regional system with wastewater being conveyed to the proposed West County Plant for treatment and discharge to the Ohio River. Future development will be served by on-site systems or by tying into the existing Black Pond Interceptor at the choice of local developers and administrators.

4.2.1 On-Site Systems

There are over 20,000 existing on-site systems in the Mill Creek area serving single-family dwellings, mobile homes, multi-family dwellings, and non-residential units. Under Alernative 7b, approximately 400 residential units will continue the use of on-site systems.

The typical on-site system in Mill Creek consists of a septic tank and seepage pit. A septic tank is a watertight tank, usually constructed of concrete, that receives and treats all wastewaters from a house or other source. Residential tank volumes usually range from 3 to 6 m^3 (750-1,500 gal), depending on the size of the house and state or local sizing requirements. As wastewater passes through the septic tank, the heavier solids sink to the bottom and the lighter particles rise to the surface; partially treated liquid flows from the tank to the disposal area. Liquid detention time in the tank

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is usually two to four days. The solids remaining in the tank undergo anaerobic decomposition. The septic tank must be pumped out periodically--usually every 2 to 5 years--to prevent solids from building up and overflowing the tank into the disposal area, where the solids can clog the soil pores until the absorption system eventually stops functioning. The septage that is pumped out of the septic tanks is discharged into the Morris Forman system for further treatment and disposal.

A seepage pit is a lined, circular pit approximately 1.2 m (4 ft.) in diameter and 6 m (20 ft.) or more deep. The bottom of the pit is filled with gravel or crushed rock to a depth of 0.3 to 0.6 m (1 to 2 ft.). Wastewater is discharged to the pit and seeps through the gravel into the surrounding soil. The depth of the pit is dependent on the location of suitable soil for absorption and renovation of the wastewater. In Mill Creek the seepage pits are extended through the non-porous upper soils of clay and discharge into the underlying glacial sand and gravel.

Septic tanks are designed to last approximately 40 years. Should structural failure of the septic tank occur, sewerage could rise to the ground surface and/or back up into the house. Should failure occur it may be necessary to replace the septic tank. For houses on 0.1 ha (0.25 ac) lots or smaller, it may be difficult to get the construction equipment required to replace the septic tank into the back yard. In this situation it may be necessary to use an alternate, potentially more expensive means of replacement. By the year 1995, 4,170 units will be 40 years old. An additional 10,800 units will be 40 years old by the year 2005. The costs for on-lot systems in alternatives utilizing those systems assumed replacement after 40 years of service.

Wastewater management for future growth would be by septic tank and seepage pit or by connection to the existing sewer system. An exception to this is the Waverly Hills Apartments. A 227 m^3/d (0.06 mgd) treatment plant has been built to serve approximately 480 future multi-family units. Septic tank use in Jefferson County is constrained by a 1978 Health Department regulation (Chapter III, Rule 8, of the Sanitary Code of the Louisville and Jefferson County Board of Health) to lots of 5 ac (2 ha) or more, except on bulding lots that existed before June 1, 1978. This regulation would have to be adjusted for the Mill Creek area in order for future development to occur on septic tanks. No adjustments are necessary for future populations to tie into the existing Black Pond Interceptor.

Management of the on-site system would continue to be the responsibility of the homeowner. Responsibilities of the homeowner include having the septic tank pumped out every 2 to 5 years and replacing the septic tank and/or seepage pit should they fail.

The initial capital and O & M costs for a septic tank and seepage pit are $1,950 and $43/yr. respectively (in January 1981 dollars).

4.2.2 Small-Area Treatment Plants

Of the existing 26 WWTP's, 18 are proposed to be served by the preferred alternative. Several options are available to the remaining 9 WWTP's, including: upgrading for surface water discharge, seepage pit disposal, or conveying wastewater to the existing Black Pond Interceptor or the proposed Dixie Highway Interceptor. Table 19 lists the NPDES permit number, the design flow, the liquid and sludge treatment method, and the receiving stream for each of the 8 remaining WWTPs. The treatment plant locations are shown on Figure 2. The effluent disposal method will be determined by the treatment plant owner and will be based on cost, soil suitability, and the ability to get a discharge permit for the selected method. If the plants are retained and upgraded, the effluent disposal method is likely to be 1 of 2 alternatives: surface water or subsurface discharge.

Surface water discharge would require an effluent in conformance with the standards shown in Table 7. Each of the extended aeration WWTPs would require upgrading, as described below, to produce an effluent suitable for discharge to surface waters:

1. Plant effluent would be treated by sand filtration.

2. Sand filter effluent would require reaeration to meet the dissolved oxygen discharge standard.

The treatment facilities at the Wade Shacklette School would require additional upgrading to extended aeration for the surface water discharge alternative.

For subsurface effluent disposal, any treatment process achieving solids removal and disinfection would be appropriate for most discharge sites. Design criteria established by the Jefferson County Sanitary Code were used for preliminary seepage pit design.

Under either discharge alternative, those plants that will be 30 years old before the end of the planning period that may need to be replaced:

Kerrick Elementary School
Pleasure Ridge Park High School
Sanders Elementary School

Replacement will probably occur in conjunction with the upgrading of the plants. Those plants that discharge to seepage pit will be replaced with a primary settling and chlorine disinfection. Those plants that will continue to discharge to surface waters would be replaced with extended aeration package treatment plants. Those plants that will use subsurface effluent disposal and do not need to be replaced will continue the use of their existing treatment system before discharge to a seepage pit.

Additionally, the option of tying into the existing Black Pond Interceptor or the proposed Dixie Highway Interceptor and then to the West County Treatment Plant are technically plausible (pump station and small-sized force main) and potentially economically attractive.

The estimated capital and O & M costs for the small WWTP options are listed in Table 20 and are updated to January 1981 dollars.

TABLE 19. SMALL WASTEWATER TREATMENT PLANTS IN THE PREFERRED ALTERNATIVE

Name(a)	NPDES Permit No.	Design Flow		Treatment Methods		Receiving Stream
		m^3/d	gpd	Liquid	Sludge	
5. Sanders Elementary School	00027138	28	7,500	Extended Aeration	Hauling	Davis Run Creek
9. Eisenhower Elementary School	00026999	57	15,000	Extended Aeration	Hauling	Mill Creek (600 Trib.)
11. Pleasure Ridge Park High School	00027120	250	65,000	Extended Aeration	Hauling	Mill Creek (Unnamed Trib.)
12. Conway Middle School	00027197	57	15,000	Extended Aeration	Hauling	Mill Creek (Unnamed Trib.)
14. Shacklette, Wade School	00027014	30	8,000	Lagoon	Hauling	Ohio River
22. Kerrick Elementary School	00027090	28	7,500	Extended Aeration	Hauling	Big Run (Unnamed Trib.)
23. Wellington Sara Belle School	00027103	28	7,500	Extended Aeration	Hauling	Ohio River
25. Johnsontown Elementary School	00026310	57	15,000	Extended Aeration	Hauling	Ohio River

Sources: NPDES Permit information: Louisville and Jefferson County Department of Public Health; Kentucky Department for Natural Resources and Environmental Protection

(a) Numbers keyed to plant locations in Figure 2.

TABLE 20. CAPITAL AND ANNUAL OPERATING COSTS FOR SMALL WASTEWATER SYSTEMS IN THE PREFERRED ALTERNATIVE (In Thousands of January 1981 Dollars)

	Advanced Treatment With Surface Water Discharge		Primary or Secondary Treatment With Subsurface Discharge		Pump Station and Force Main to Black Pond Interceptor	
	Capital Cost	Operating Cost	Capital Cost	Operating Cost	Capital Cost	Operating Cost
Sanders Elementary School	154	12	116	9	82	1.5
Eisenhower Elementary School	51	12	39	9	186	1.5
Pleasure Ridge Park High School	521	23	363	17	136	1.7
Conway Middle School	51	13	40	10	92	1.5
Wade Shacklette School	115	12	29	9	105	1.5
Kerrick Elementary School	154	12	116	9	184	1.5
Sara Belle Wellington School	51	12	28	9	148	1.5
Johnsontown Elementary School	51	13	41	10	136	1.5

Note: Capital costs include treatment plant construction, land acquisition, collector system construction, and engineering fees. Operating costs cover treatment plant and conveyance system. Dashes used where expansion of the service area is not likely.

4.2.3 Regional Treatment System

The regional system will serve approximately 400 commercial units along the Dixie Highway corridor and 18 WWTPs (the number in parenthesis is keyed to Figure 2):

Valley Village Subdivision (1)
Valley High School (2)
Villa Anna (3)
Beth Haven Baptist Church (4)
Westland Mall (6)
Timothy Hills Subdivision (7)
Eden Apartments (8)
Waverly Hills Apartments (10)
S. W. Jefferson County Government Center (13)
R & W Laundromat (15)
Havalock Subdivision (16)
Silver Palms Swim Club (17)
Cardinal Mobile Home Park (18)
Fordhaven Subdivision (19)
West Springfield Subdivision (20)
Forest Hills Subdivision (21)
River Valley Mobile Home Park (24)
Woodhaven Medical Services (26)

Interceptors will convey the wastewater by gravity to a planned 2.19 m^3/s (50 mgd) West County Treatment Plant. Treatment will be by the conventional activated sludge process with anaerobic sludge digestion. The average daily flow from Mill Creek to the West County Treatment Plant would be 130 L/S (3 mgd).

Interceptor alignments are shown on Figure 14. Interceptors OR-1, VT-2, and VV-1 would be constructed as designed by MSD for the 201 plan. The interceptors along Dixie Highway were designed using the design criteria set forth in MSD's Design Manual. The interceptors size ranges and costs are given in Table 21. Unit costs for the Dixie Highway interceptors were developed from data available to Gannett Fleming Corddry & Carpenter, Inc. and are listed in Table 22. Costs for the OR-1, VT-2, and VV-1 interceptors were obtained from MSD and updated to January 1981 dollars (Table 21). The interceptor O & M cost is \$0.33/km (\$0.54/mi).

Cost estimates for the West County treatment plant are based on the preliminary draft Final Design Report Summary for the West County wastewater treatment plant which was prepared for MSD by CH_2M Hill. These costs have not, however, been approved by EPA. The cost was prorated on the basis of flow to show only the costs attributable to Mill Creek. The total capital costs for the West County treatment plant, in January 1981 dollars, is \$117 million. The cost attributable to Mill Creek is \$7 million. The total O & M costs for the West County treatment plant for 1985 and 1995 are \$2.4 million/yr. and \$4.3 million/yr., respectively. The O & M costs attributable to Mill Creek are \$0.15 million/yr. and and \$0.26 million/yr. for 1985 and 1995, respectively.

TABLE 21. INTERCEPTOR SIZES AND COSTS

(Cost in Thousands of January 1981 Dollars)

Interceptor	Size Range in	Size Range cm	Cost
DH-1	27-36	69-91	2,650
DH-2	8-12	20-30	450
DH-3	12-21	30-53	1,210
DH-4	10-15	25-38	670
DH-6	10	25	790
DH-7	10	25	720
DH-8	10	25	620
OR-1	8-12	20-30	170
VT-2	10-30	25-76	1,180
VV-1	24-27	61-69	580

TABLE 22. UNIT COSTS FOR THE DIXIE HIGHWAY INTERCEPTORS

		Capital Cost [a] ($/ft) [b]
Vitrified Clay Pipe		
8-inch [c]	8-14 ft. deep	51
10-inch	8-14 ft. deep	51
10-inch	14-20 ft. deep	62
10-inch	20-30 ft. deep	88
10-inch	>30 ft. deep	107
12-inch	8-14 ft. deep	56
12-inch	20-30 ft. deep	90
15-inch	8-14 ft. deep	62
Reinforced Concrete Pipe		
21-inch	20-30 ft. deep	129
27-inch	20-30 ft. deep	152
27-inch	>30 ft. deep	179
36-inch	20-30 ft. deep	190
36-inch	>30 ft. deep	219
42-inch	20-30 ft. deep	208

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[a] Costs include installation, excavation and backfill, pavement replacement, and traffic control.

[b] $/ft x 3.28 = $/m

[c] in. x 2.54 = cm

4.3 Socio-Economic Impacts and Mitigative Measures

4.3.1 Cultural Resources

Cultural resources within the study area are primarily composed of deeply buried pre-historic sites. These sites occur somewhat more commonly on the floodplain than in the uplands, and only rarely in the Scottsburg lowlands. The proposed alternative would not affect any known sites, but undiscovered sites may be affected by excavations for sewer placement, septic tank installations, and seepage pit construction. The impact of these excavations could be considered positive if a significant site is discovered, or negative if a discovered site is disrupted and damaged. Negative impacts could be mitigated by providing for archaeological inspection during excavations to identify site indicators and allowing the archaeological investigation of discovered sites.

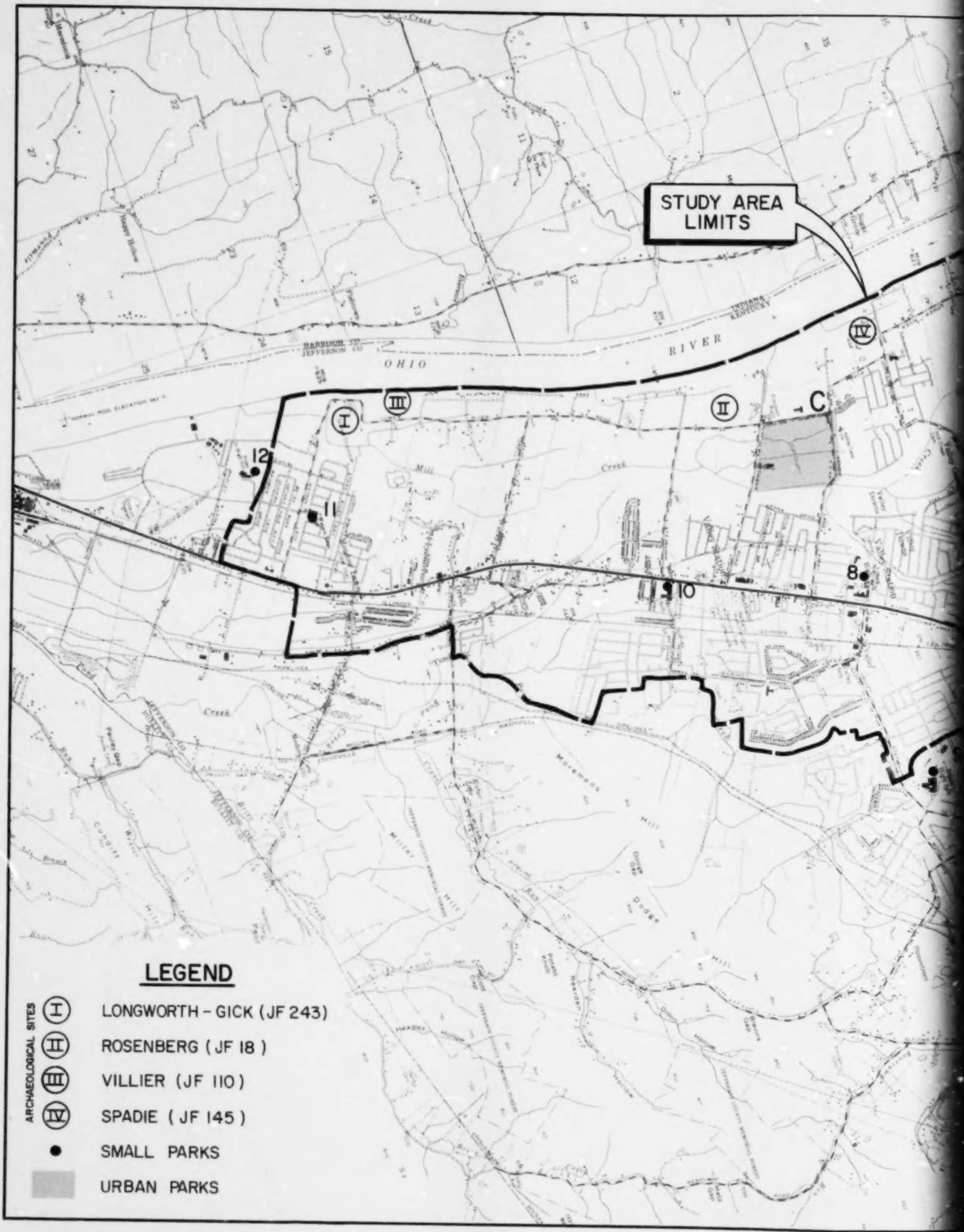
4.3.2 Recreational Resources

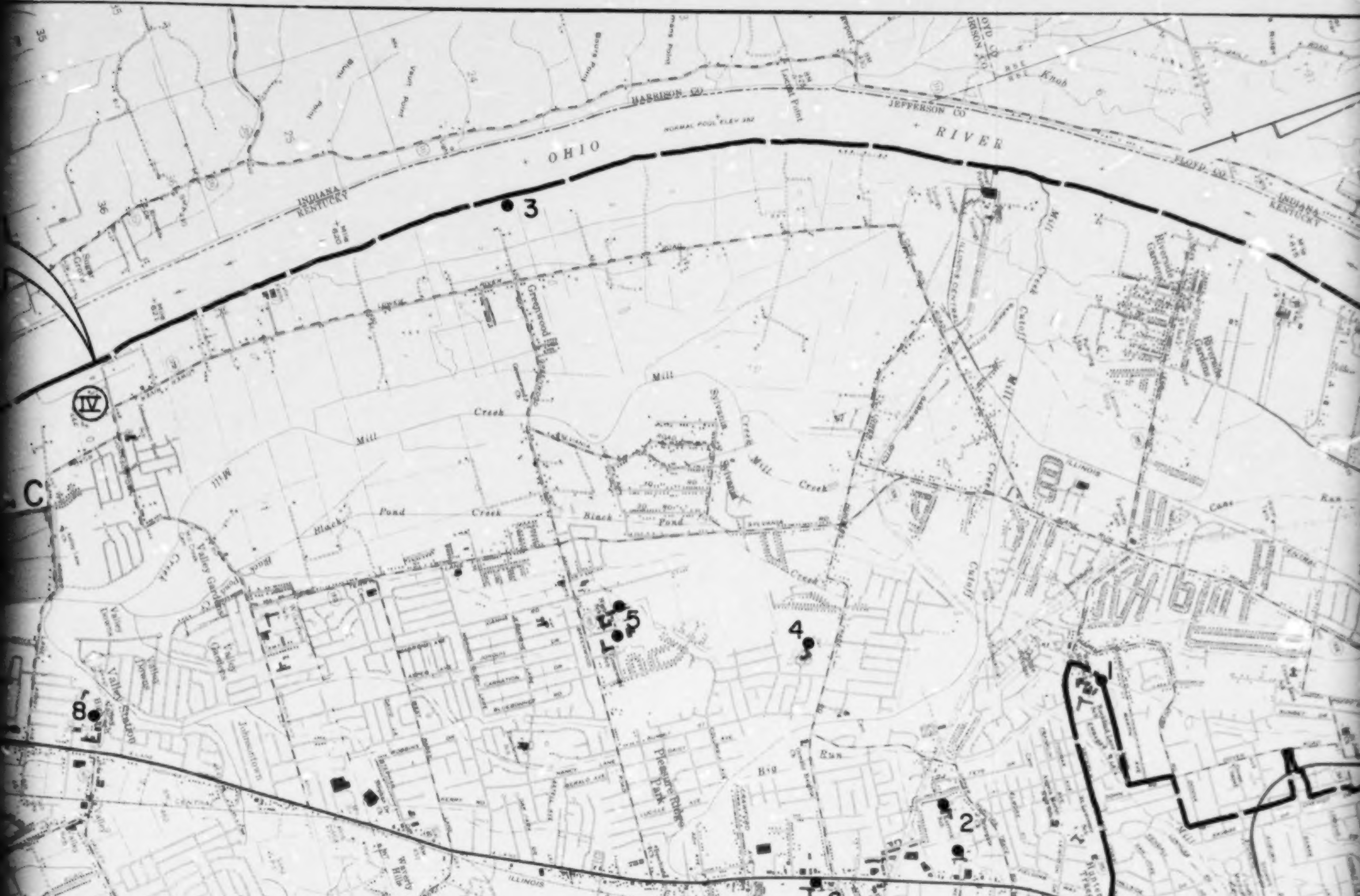
Parks, playgrounds, and other related outdoor facilities were considered in the recreation inventory of the Mill Creek study area. Major urban parks and small community parks are shown in Figure 15. In addition, there are numerous small neighborhood parks (school playgrounds, sports fields and courts) which are identified in the Outdoor Recreation Plan (LJCPC 1973). The urban parks and most small parks will not be affected by the proposed alternative. Small parks 6 and 10 (Waller Elementary and Medora Elementary Schools, respectively) and three parochial schools (Bishop David High, St. Paul's Elementary and Our Lady Help of Christians Elementary Schools) lie along Dixie Highway and would be affected by construction noise during the regional interceptor placement. Adherence to local noise regulations would help mitigate the impact of construction noise.

4.3.3 Public Health and Welfare

Removing or reducing discharges from small treatment plants to small streams would reduce the potential risk of infection from informal recreational use of streams in the study area. The health risk is posed by possible inadequate disinfection of treatment plant effluent before discharge.

Continued use of subsurface disposal of septic tank effluent by the present and future residential population served by septic tanks would continue the existing impact to groundwater. The selection of seepage pit disposal for the eight remaining small treatment plants would increase the impact to groundwater quality. It is anticipated that Mill Creek area groundwater will be unacceptable as an untreated drinking water source under this alternative. To mitigate potential health problems, users of private wells should be connected to treated public water supplies. At a minimum, private well water should be disinfected prior to consumption. Regardless of which alternative is selected, connection to public water supplies is encouraged because of the time required to implement any alternative, even the most groundwater-protective alternative.


STUDY AREA LIMITS
OHIO
RIVER
INDIANA
KENTUCKY
HARRISON CO
JEFFERSON CO
Mill
Creek
I
II
III
IV
C
8
10
11
12
LEGEND
ARCHAEOLOGICAL SITES
I LONGWORTH - GICK (JF 243)
II ROSENBERG (JF 18)
III VILLIER (JF 110)
IV SPADIE (JF 145)
● SMALL PARKS
▨ URBAN PARKS



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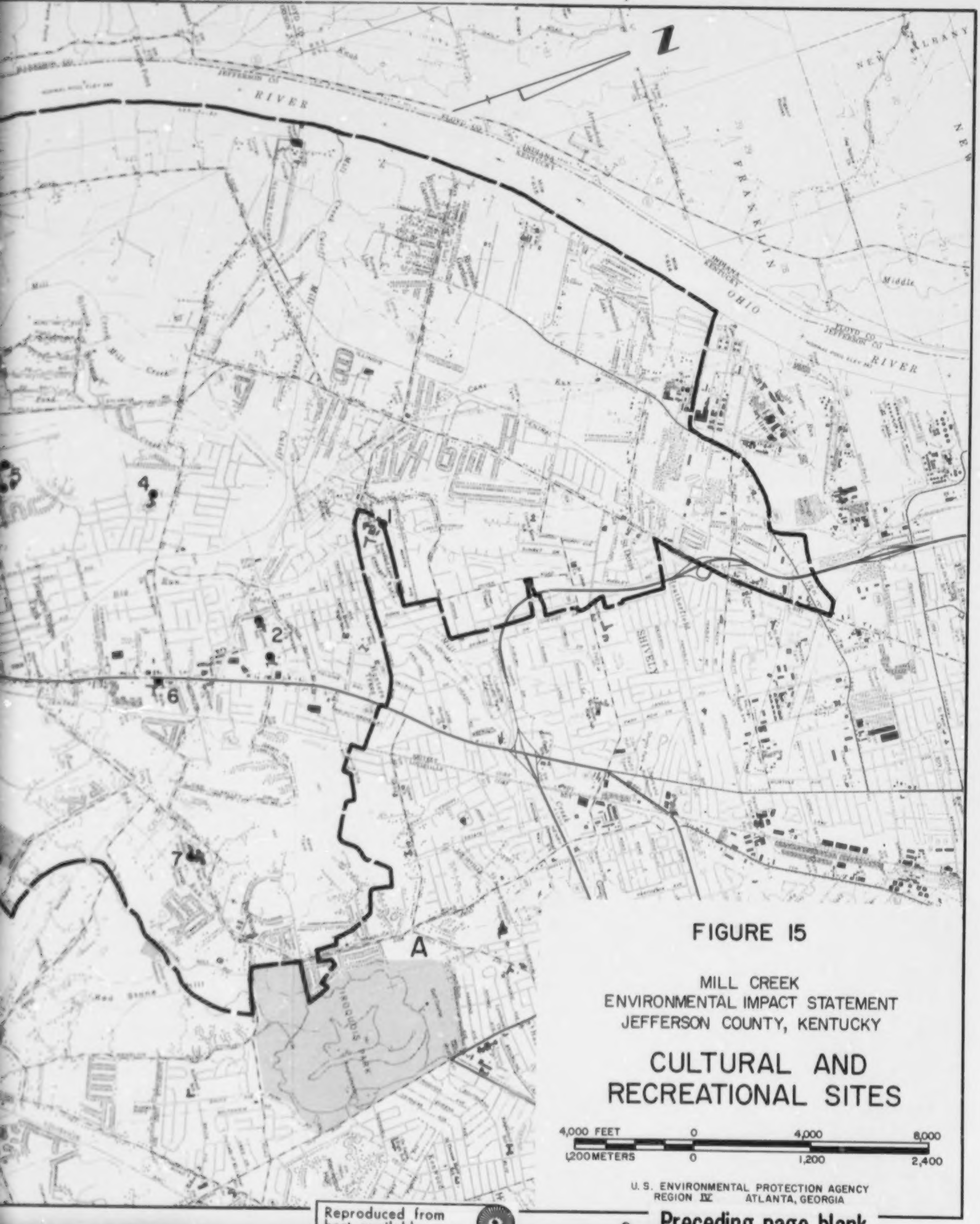

FIGURE 15

MILL CREEK
ENVIRONMENTAL IMPACT STATEMENT
JEFFERSON COUNTY, KENTUCKY

CULTURAL AND RECREATIONAL SITES

4,000 FEET 0 4,000 8,000
1,200 METERS 0 1,200 2,400

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REGION IV ATLANTA, GEORGIA

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4.3.4 Employment

A short-term benefit to local employment would occur during interceptor and regional plant construction. Long-term opportunities will increase slightly (regional plant operation and interceptor maintenance) but the effect will be limited because the system capacity is related to present flows and would not be expanded with population growth.

4.3.5 Housing and Population

The proposed alternative calls for future population to be served by septic tank systems or tie into existing sewers. The combination of these options should provide sufficient flexibility to accommodate a mix of single family housing on septic tanks and multi-family housing tied into the existing sewers. Existing Health Department regulations require lots greater than 5 acres for septic tank use. If no adjustments of this regulation are forthcoming for the Mill Creek area, single family housing unit number and density would certainly reflect this constraint, while providing impetus for dense single family and multi-family housing to locate near areas that could be served by existing sewers.

4.3.6 Land Use

The preferred alternative would have a mixed effect on land use in the study area. The existing land use pattern is such that commercial land use is generally concentrated along the major transportation corridor of Dixie Highway, residential land use is west of Dixie Highway, and industrial land use is primarily along the Ohio River. The Dixie Highway Interceptor component of the preferred alternative plus the existing Black Pond Interceptor provide sufficient direction for existing land patterns to continue. A regional system may provide for greater flexibility in type and density of development, while increased septic tank use would favor single family housing. However, the availability of existing and proposed interceptors should not preclude land use diversity in those areas.

4.3.7 Community Services

Community services would be affected by disruption of Dixie Highway traffic during construction of the regional interceptor. To mitigate the impact to traffic flow and access to commercial establishments the interceptor design should minimize the number of Dixie Highway crossings and minimize the length of open trench during placement of the interceptor.

4.3.8 Local Economy and Finances

Generally, the proposed regional system would have a beneficial impact to the local economy by increasing the value of commercial property along Dixie Highway (with a concomitant increase in tax revenues) and by increasing the number of users of the MSD system (with a concomitant increase in revenue to MSD). A more complete discussion is included in Section 4.6 of this document and in Appendix A, the Financial Impact Analysis document.

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4.3.9 Public Acceptance

Reaction to the proposed alternative should be generally favorable from both residents and businesses in the study area. Residents served by the small treatment plants that would be abandoned could face a lower user charge when connected to the MSD system. Owners of the plants, however, can be expected to resist abandonment unless compensation is provided. Residents using septic tank systems have expressed their desire to keep those systems, and would be accommodated under the proposed alternative. Businesses along Dixie Highway would likely welcome the regional interceptor because it would remove their responsibilities for on-site system management and increase the value of their properties.

4.4 Environmental Impacts and Mitigative Measures

4.4.1 Soils

The proposed alternative would have minor local impacts on soils in the study area. Limited erosion and mixing of soil horizons would occur from constructing the regional interceptor along Dixie Highway and sewers to connect the areas served by the small treatment plants that would be abandoned. Along Dixie Highway, soils would be exposed as trenches are dug for the interceptor. Connecting sewers from abandoned treatment plants would be placed along stream corridors and streets. Good soil erosion control practices would mitigate adverse impacts during construction and post-construction impacts could be mitigated by resurfacing disturbed streets and replanting vegetation along disturbed stream corridors.

4.4.2 Odor

By connecting businesses along Dixie Highway to the regional system and abandoning their on-site systems, the proposed alternative would relieve odor problems caused by failing on-site systems. Potential odor problems from malfunctions at the remaining small treatment plants could be controlled or limited if seepage pit discharge is selected rather than continued surface water discharge.

Adverse impacts may result from improper operation of the regional and remaining small treatment plants, and remaining and future septic tank systems. Potential odor problems could be avoided by proper treatment system operation.

4.4.3 Noise

Noise would be created by several aspects of the proposed alternative. Short-term impacts from construction noise during interceptor placement would be significant, particularly affecting close-quarter businesses along Dixie Highway. Neighborhood noise levels would be increased in the short-term by construction of other interceptors and the regional treatment plant, by the upgrading or dismantling of small treatment plants and by seepage pit construction. To mitigate these adverse impacts, project activities should conform to local noise regulations.

4.4.4 Terrestrial Ecology

Adverse impacts will result from construction of sewers along stream corridors by disturbing natural vegetation and disrupting wildlife habitat. These impacts can be mitigated by replacing vegetation, making minor route changes to avoid large trees, and restricting construction right-of-way to the minimum necessary for construction equipment.

4.4.5 Surface Water

The water quality of small streams in the study area would be improved by relieving pollutant loadings from the abandoned small treatment plant, remaining small plants that use seepage pits, and overflows from failing septic tank systems along Dixie Highway. however, the concomitant decrease in flow may cause some streams to periodically dry up, i.e. at times, treatment plant discharge is the only source of flow.

Some siltation of streams during interceptor construction would be expected but would be minimal because of the limited construction along streams, siltation could be controlled by the incorporation of good soil erosion control practices during construction activities.

A relatively slight increase in the pollutant loading to the Ohio River would result from operation of the regional treatment plant. The impact of this increased loading would be negligible when compared to other West County outfalls and considering the magnitude of the Ohio River flow. Proper operation of the regional plant would insure that discharge impacts remain insignificant in the long-term.

4.4.6 Aquatic Ecology

To the extent that water quality in small streams will be improved, a beneficial impact would be realized by a potential increase in the diversity of aquatic species in the streams. However, as noted earlier, some streams may dry up at times, limiting the aquatic community to species that can withstand a temporary absence of water and species that would re-enter the stream system when flows return.

The effect of the alternative on the Ohio River ecology would be negligible.

4.4.7 Groundwater

Groundwater in the study area has been affected by the use of seepage pits for septic tank effluent disposal. The proposed alternative would discontinue the use of seepage pits by businesses along Dixie Highway, but continue seepage pit use by present and future residential users and by the eight remaining small treatment plants if surface water discharge is discontinued. Therefore, the quality of area groundwater would continue to be influenced because of continued and increased septic tank discharges.

4.5 Recommendations

4.5.1 Priority Criteria

This EIS demonstrates that the most cost-effective, environmentally sound action for the Mill Creek area would be to implement Alternative 7b. It is important to note that the proposed action for the Mill Creek area must be assigned a priority for implementation in the context of the needs of the entire portion of Jefferson County. The appropriate forum for assignment of priority is through a local evaluation process combined with consideration (for these portions of projects which are either EPA grant eligible or are dependent on EPA eligible projects) of Kentucky's assignment of priority and resulting expected fundability. This process should reestablish the extent and focus of the County sewer expansion program by setting priorities for program segments clearly based on environmental and public health needs in light of the latest cost and environmental information, as well as the availability and timing of funding. For example, there would be little point in setting a high local priority for projects that the state priority list showed for either low or no priority.

This procedure should be directed toward establishing priority for the following Jefferson County program segments:

1. The Mill Creek proposed action,
2. Mill Creek future development,
3. Pond Creek sewering,
4. The West County treatment plant,
5. Morris Forman diversions,
6. County-wide sludge management,
7. North County EIS proposed action, and
8. Floyds Fork wastewater management.

Although the priority of implementing Alternative 7b in the Mill Creek area will be determined through this process, certain critical public health and water quality needs are clear. Pond Creek needs have been recognized by MSD and EPA since 1974 to be extremely urgent. Further, preliminary evaluations related to the North County EIS have provided extensive evidence of serious public health problems posed by failing on-site systems.

In placing the Mill Creek area draft EIS preferred alternative in perspective with Jefferson County's other wastewater management problems, it becomes clear that other projects such as the West County - Pond Creek System, the North County project, and Morris Forman system improvements should proceed as rapidly as possible. The correction of existing surface water discharge problems and problems associated with the use of on-lot systems by commercial establishments along Dixie Highway are also high priority. In setting these priorities, future options for the Mill Creek area residential on-lot systems should remain flexible. Certain general criteria for determining when and under what circumstances the Mill Creek area residential on-lot systems should receive a higher priority rating would be helpful. These criteria should also provide a basis for proceeding with the critical correction of water quality and public health problems occurring elsewhere in the County. The criteria can address, in general terms, the parameters involved in future decisions regarding Mill Creek priorities, and the reasons for the higher priorities of the other, more critical areas of the County.

Typically, the evaluation of site suitability for septic tank use considers constraining physical conditions such as depth to bedrock, percolation rates, seasonal high water table, population density, etc. The general priority criteria that are addressed in this EIS will expand upon these conventional physical parameters and concentrate on criteria with specific application to the wastewater problems of Mill Creek and Jefferson County.

This initial development of priority criteria involves the consideration of factors that are critical to determining existing priority and for determining when and under what circumstances a lower priority area should be reassigned a higher priority. Local and state evaluations should be directed toward refining these general priority criteria and determining local priority positions.

The following criteria for determining existing and future priority positions are proposed:

1. The development of or the future likelihood of adverse public health impacts from septic tank failures.
2. The occurrence of significant functional or operational failures of septic tanks.
3. A rise in groundwater levels that adversely affects septic tank operation.
4. The establishment of a plan for use of groundwater as a public water supply source where existing on-lot operations preclude such use.
5. Significant, demonstrable adverse land use impacts caused by constraints from established wastewater management operations.

Discussion of Criteria

1. The development of or the future liklihood of significant public health impacts from septic tank failures.

The elimination or avoidance of adverse public health impacts is a critical concern in wastewater management. These impacts could include changes in water quality, increases in pollution levels, creation of high risk situations or the aggravation of an existing problem resulting in public health risks. For the purposes of this study, impacts to public health relate primarily to existing and future uses of surface and groundwater resources. These uses include body contact and consumption.

The quality of Mill Creek area groundwater, has been determined by the EIS Groundwater Program to be influenced by existing septic tank use and not suitable as an untreated drinking water source. The sampling program showed some cases of high nitrate levels and elevated bacterial levels. The potential for public health impacts related to groundwater influenced by septic tanks is, however, tempered by limited existing and future use of groundwater. Additionally, since the incidence of system failure in the Mill Creek area is extremely low, the potential for human contact with failing systems is also low. Therefore, the existing situation in Mill Creek and the future situation under the Draft EIS preferred alternative are cases in which public health problems are not expected to develop. Other areas of the County are, however, experiencing substantial on-site system failure and therefore exhibit greater potential for human contact with failing systems and waters impacted by these systems.

The significance of this criterion in re-establishing priorities can be determined by relating the characteristics and circumstances of system failures to the potential for public health impact. This relationship should consider the rate of septic tank failure, the cause of failure (maintenance problems, unsuitable soils, high water table, etc.), the nature of failure (ponding, overflows, backing-up, etc.), the water quality impact, and the use of the resource being impacted (potential for human contact). By monitoring these situations and documenting changes in established or expected conditions, the redefinition of a priority may be appropriate.

2. The occurrence of significant functional or operational failures of septic tanks.

For septic tank systems to be successful, they must be operationally sound and functional. The failure of an on-site system can be attributable to site constraints, lack of maintenance or structural failure. In those cases where significant structural failure has resulted in system failure, the options include rehabilitation or sewering. In many cases of structural failure, the site is still suitable for continued system use, however, if significant numbers of on-site systems are experiencing structural failure, rehabilitation or replacement may not be feasible because of technical difficulties, cost or potential public health impacts. These instances should be analyzed on a case by case basis in order for the significance of this criterion to be determined.

3. A rise in groundwater levels that adversely affects septic tank operation.

It has been reported in the past that groundwater levels in Louisville are rising. This does not seem to be the case in the Mill Creek area despite the contribution to groundwater from on-site systems. In order for septic tank systems to be successful; a sufficient zone of subsurface soils between the disposal unit (lateral field or seepage pit) and the groundwater table is needed. In recognition of this need, Section 304.406 b (6) of the Sanitary Code of the Louisville and Jefferson County Board of Health requires that "whenever, in the course of construction, the (seepage) pit bottom penetrates the subsurface water table, the bottom of the pit shall be filled with clean, coarse sand to a level at least two feet above the water table." Therefore, the application of this criterion for re-establishing priority positions would be appropriate when groundwater levels rise to the point that operations of a significant number of septic tank systems are impaired and measures are not available to mitigate these operational problems.

4. The establishment of a plan for use of groundwater as a public water supply source where existing on-lot operations preclude such use.

Most of Jefferson County's water supply needs are met by the Louisville Water Company (LWC). At present, the Ohio River is the sole source of raw water for the LWC, which is permitted by the Kentucky DNREP to withdraw a yearly average of over 200 million gallons per day. In areas where LWC lines have not been extended, water supply is provided by private water wells. For example, 300-600 homes (1-2%) in the Mill Creek area may use private wells for water supply.

In the event that groundwater is proposed to be used as a public water supply source, measures should be taken to minimize water quality degradation. In the case of Mill Creek area groundwater, the EIS groundwater program found that groundwater was being influenced by existing septic tank use (some elevated nitrate and bacteria levels) and is not suitable as an untreated drinking water source. It was also indicated that the potential for public health impacts related to groundwater influenced by septic tanks is tempered by limited existing use and future use of groundwater. With regard to future use, the LWC has indicated that there are no short or long-term plans to use the groundwater in southwest Jefferson County. Nevertheless, data indicate the Mill Creek area groundwater could now, and even in the future with increased wastewater discharges, be used as a raw water source. With the application of conventional disinfection, the finished drinking water would be expected to be well within established finished drinking water criteria.

If, however, conditions and policies were to change and the LWC proposed to use Mill Creek area groundwater, it may be appropriate to minimize the impact on groundwater quality.

5. Significant, demonstrable adverse land use impacts caused by constraints from established wastewater management operations.

It is expected that under the Draft EIS preferred alternative, future development can be accommodated by on-site systems and existing sewer lines. This wastewater management system should allow for existing land use patterns to continue. If, however, a significant shift in expected development patterns, trends or types would develop that could not be adequately served by the preferred alternative, adjustments or modifications to the system configuration may be appropriate.

4.5.2 Well-Water Use

As previously noted, most of Jefferson County's water supply needs are met by the Louisville Water Company (LWC). At present, the Ohio River is the sole source of raw water for the LWC. Most of the Mill Creek area EIS study area is served by the LWC. Currently, no water utility uses the area groundwater for public water supply. However, certain study area households depend upon groundwater for domestic use due to the absence of nearby water mains. Apparently, between 300-600 residences (1-2% of the study area) may depend upon private water wells for water supply.

The EIS groundwater program involved an evaluation of area groundwater quality and concluded that because of nitrate and bacterial levels, area groundwater was not suitable as an untreated drinking water source. It is expected that these conditions would persist for several years, regardless of which alternative is selected.

Because of the existing questionable suitability of the aquifer as an untreated drinking water source, EPA encourages local agencies to extend public water service to those Mill Creek residences not now served. In the cases where service can not be extended, a groundwater quality monitoring program could include special emphasis on monitoring areas that would rely on groundwater for private water supply. Under any circumstance, private water supply users should be encouraged to disinfect area groundwater prior to consumption.

Where area groundwater is being consumed by infants, special precautions should be taken to preclude the long-term consumption of groundwater high in nitrates (above 10 mg/1). Serious or occassionally fatal poisonings in infants under 3 months of age have occurred in North America and Europe following ingestion of untreated well waters shown to contain nitrate at concentrations greater than 10 mg/1 nitrate-nitrogen. This reaction is called infant methemoglobinemia. To avoid this reaction, it is recommended that: (1) area groundwater not be used for infant feeding but either public water or bottled water be substituted, or (2) private water supplies being used for infant feeding be routinely monitored for nitrates to assure concentrations are sufficiently low to avoid adverse health effects.

4.6 Financial Impact Analysis

4.6.1. Purpose

The EIS Financial Impact Analysis (FIA) has been carried out to determine the likely impacts on the Louisville and Jefferson County Metropolitan Sewer District (MSD), MSD's customers, and residents in the Mill Creek EIS study area of various alternative wastewater management approaches. The study was initiated by U.S. EPA to address concerns raised by agencies of Jefferson County and the Commonwealth of Kentucky regarding the financial feasibility of EIS alternatives. Financial feasibility has been examined by developing projected revenue needs and customer service charges for alternative approaches in Mill Creek, ranging from no federal action to regional sewerage system.

4.6.2 Summary

The financial impacts of several wastewater management alternatives were evaluated by developing cash flow projections for the MSD system under the following conditions:

1. Scenarios 1 and 2 involved construction of a regional sewerage system in the Mill Creek area;
2. Scenarios 3 and 4 involved no federal action, and therefore no public sewerage system in the Mill Creek area; and
3. Scenarios 5 and 6 involved two limited public sewer systems in the Mill Creek area.

Cash flow projections were made by developing postulated capital improvement programs for each of the scenarios. Capital improvement expenditures were disaggregated into planning, engineering, land acquistion, and construction costs. The timing of capital improvement activities and number of customers to be served by each project were additional inputs to the cash flow model. Revenue needs and customer service charges were determined for each scenario by utilizing a cash flow model developed by MSD. Costs of wastewater management to Mill Creek residents not served by MSD were projected under the same economic circumstances as those used in cash flow modeling.

Significant findings of the financial impact analysis are as follows:

1. All scenarios showed essentially the same revenue requirements and customer service charges through 1995.
2. Mill Creek activities had no noticeable effect on either MSD's revenue requirements or projected MSD customer service charge.
3. Projected MSD customer service charges were consistently larger than projected costs of service allocable to Mill Creek MSD customers.
4. Public sewerage projected costs appeared to be consistently lower than projected costs for existing private wastewater management systems.
5. Annual costs of wastewater management projected for future Mill Creek residences would be lowest for septic tanks with seepage pits and highest for small area wastewater treatment systems.

4.6.3. Conclusions

1. Through 1995, MSD activities in the Mill Creek area ranging from a complete regional sewerage system to no public system at all will have essentially the same financial impact.
2. Residences in the Mill Creek area currently served by small private sewerage systems would benefit from the substantially lower service charges projected for MSD customers.
3. The least costly wastewater management alternative, of those studied, for new residences in the Mill Creek area would be a septic tank with seepage pit. Regional sewers and large-scale treatment would be significantly less costly to new residences than small area wastewater treatment systems.

5. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES OF THE ALTERNATIVES

5.1 Introduction

This chapter contains a summary description of the baseline environmental condition of the natural and man-made environments in the Mill Creek study area.

The inventory of existing conditions serves two purposes. First, it allows an assessment of the environmental problems that need to be relieved. Second, it establishes a baseline of environmental conditions against which all alternative actions can be compared. Changes to the existing environment will be predicted on the basis of projected impacts of alternatives. An important consideration in the analysis of alternatives is the projected environmental effects of the "no-action" alternative.

5.2 Natural Environment

5.2.1 Description of the Environment

Soils and Geology

The Mill Creek area is covered mostly by outwash up to 40 m (130 ft) thick, with intermittent layers of silt, clay, sand, and gravel. Cross sections of the study area, as developed from the United States Geological Survey (USGS) Hydrologic Investigations Atlas HA-111 (Price 1964), are shown in Figure 16. Section 1-1' runs southeast from River Mile (R.M.) 616; section 2-2' runs east from R.M. 619; section 3-3' runs east from R.M. 621.

Soils vary in permeability and, consequently, in ability to accept septic tank effluent dispersed through conventional tile leaching beds. As defined by the U.S. Soil Conservation Service (SCS), the degrees of limitation of soils in residential subdivisions (four or more houses, and possibly a commercial establishment, per acre) are

Very Slight:	The soil has no significant limitation for leaching beds;
Slight:	The soil has some limitation for leaching beds, but the limitation is easy to overcome;
Moderate:	The soil has limitations that warrant recognition, but the limitation can be overcome;
Severe:	The soil has severe limitations that are difficult and costly to overcome;
Very Severe:	The soil has very severe limitations, and extreme measures are needed to overcome the limitations.

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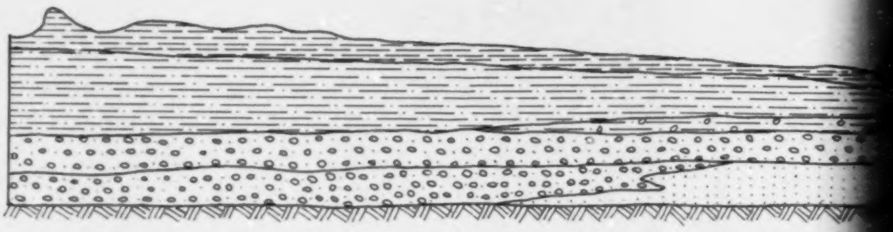

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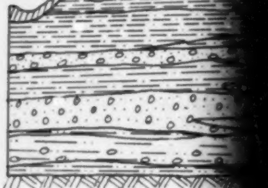

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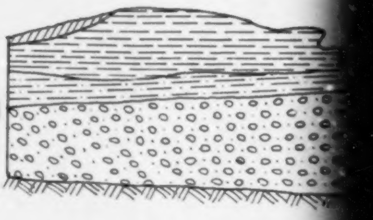

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SCALE: HORIZ
VERT

DATUM PLANE 300'

NOTE: SECTION LOCAT

SOURCE: USGS HYDROLOGIC INVESTIGATIONS ATLAS
HA-111 1964

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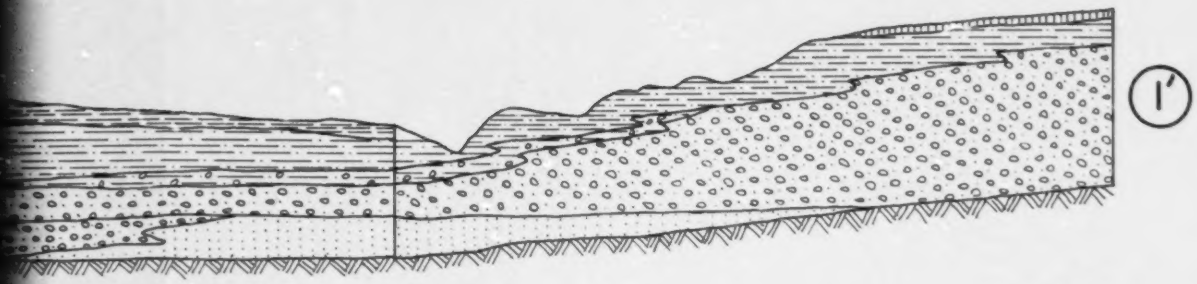

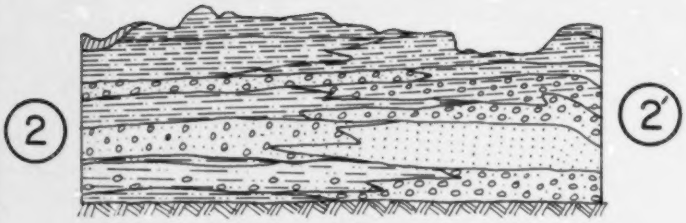

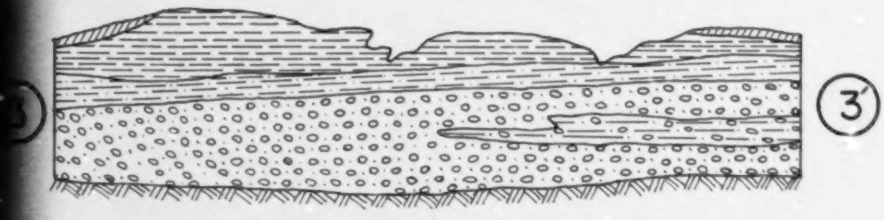

SCALE: HORIZONTAL 1" = 2000'
VERTICAL 1" = 100'

DATUM PLANE 300' ABOVE MEAN SEA LEVEL

NOTE: SECTION LOCATIONS ARE SHOWN ON FIGURE 3.

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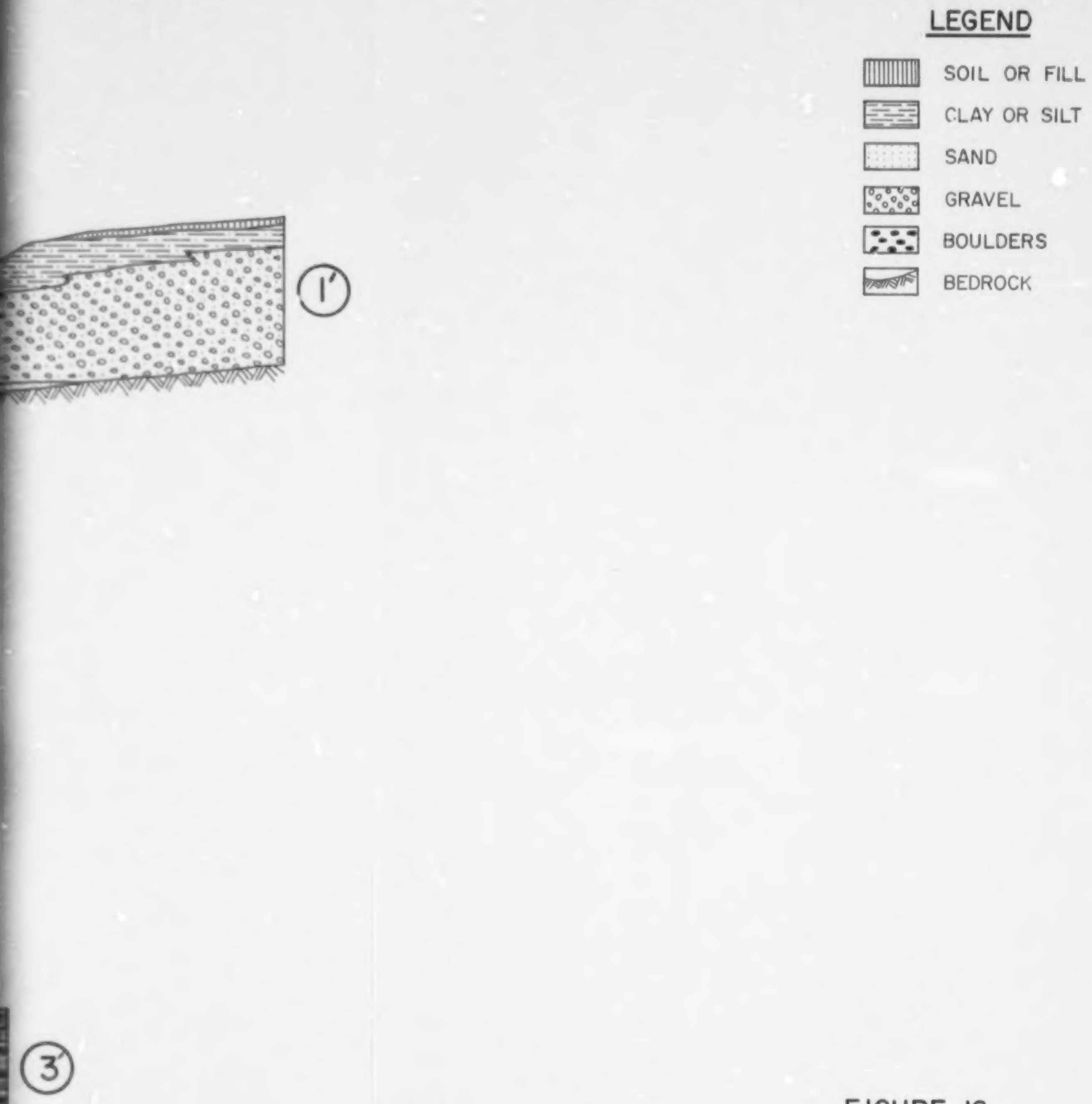

FIGURE 16

MILL CREEK
ENVIRONMENTAL IMPACT STATEMENT
JEFFERSON COUNTY, KENTUCKY

SECTION DIAGRAMS OF ALLUVIAL AND GLACIAL DEPOSITS IN STUDY AREA

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV ATLANTA, GEORGIA

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It should be noted that these soil limitations apply to the upper soil layer. Generally, the upper soils in the study area are underlain by porous, sandy materials. Seepage pits, which extend through the less permeable surface materials to the granular soils below, have proven acceptable for on-site wastewater disposal in the Mill Creek area.

Hydrology and Water Quality

The hydrology of the Mill Creek study area may be considered as a pair of systems: the groundwater and the surface-stream network. The groundwater beneath the study area is found in the Ohio River alluvial aquifer, a thick stratum of sand and gravel deposited by the continental glacier during the last Ice Age. This aquifer has been an important water resource for the Louisville area, providing water for domestic, agricultural, and industrial needs today and in the past. The baseline inventory of groundwater conditions in the study area was carried out as a separate series of tasks in the EIS program and is discussed in the next subsection.

The existing surface-waterway network in the study area is the result of many years of human construction activities. In its natural state, the study area was drained by Mill Creek and its tributaries with surface water flowing southward to the point near Kosmosdale where Mill Creek discharges to the Ohio River. A major rerouting of surface water was carried out at the time of construction of the Ohio River levee in the northern portion of the basin. The flow in what was designated Upper Mill Creek was directed to Mill Creek Cutoff and conveyed to the Ohio River in the vicinity of the Cane Run power plant. Flow in Big Run was also removed from the Lower Mill Creek system and directed to the cutoff. During periods of flooding, flows from Cane Run and Upper Mill Creek were pumped over the levee into the cutoff.

The present surface drainage network consists of the Upper Mill Creek area and the Lower Mill Creek area. The Upper Mill Creek system includes the main stem of Mill Creek, which drains most of the Shively area; Cane Run, which drains much of the land north of the cutoff and west of Cane Run Road; and Big Run, which drains a large area to the east of Dixie Highway, in the vicinity of St. Andrews Church Road, as well as land to the west of Dixie Highway, generally north of Pleasure Ridge Park. The Lower Mill Creek system consists of the Mill Creek main stem and Black Pond Creek, generally parallel to Mill Creek. The lower system also includes several man-made drainage channels which collect surface runoff and convey it to Mill Creek or Black Pond Creek. These channels are identified by number designations, such as the "600" tributary.

Historical records of flow and water quality for streams in the Mill Creek basin do not exist. However, the actual quality of Mill Creek system waters is immaterial to the determination of wastewater treatment levels required to safeguard the streams. According to the 1974 Water Quality Management Plan (WQMP) (Kentuckiana Regional Planning and Development Agency (KIPDA) 1974), nearly all small surface streams in the WQMP study area exhibit zero-flow conditions during some portion of the year. During periods of zero natural flow in a waterway, wastewater treatment plant (WWTP) discharges constitute the entire flow in the stream. The Kentucky Department of Natural Resources and Environmental Protection (KDNREP) has, therefore, classified all surface streams in the Mill Creek study area as belonging to the water quality

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limitation class. Waters thus classified require wastewater treatment to advanced levels; that is, treatment beyond secondary, before discharge.

The advanced treatment levels required for discharge into Upper or Lower Mill Creek were verified by water quality modeling carried out during the preparation of the 1974 WQMP. It was determined that the maximum 5-day biochemical oxygen demand (BOD_5) of WWTP effluent that could be discharged into streams in the two systems was in the range of 10 to 20 mg/l.

Hydrogeologic Conditions

The Mill Creek Study Area is located almost entirely within the boundaries of the Ohio River Alluvial Aquifer. The aquifer was formed during the Pleistocene epoch (the period of glaciation) when the Ohio River cut a deep, wide valley into bedrock to a depth of nearly 130 feet below the present flood plain. This valley was subsequently filled with glacial outwash sands and gravel and more recent alluvial deposits of silts and clays. (USGS WSP-189C).

In the geologic time frame, these deposits are relatively recent. Consequently, the deposits have not been transformed into sandstone or shale, but remain as unconsolidated sediments. The bedrock underlying the aquifer is the New Albany shale (USGS WSP 1579, USGS Map GQ-1202) of Devonian age. The shale, which is approximately 100 feet thick, has a gentle dip of about 40 feet to the mile toward the west (USGS C-276).

The localized hydrologic cycle involves the percolation of water downward from the surface by gravity as it travels through the unsaturated zone to the water table. Upon reaching the saturated zone, the water travels down-gradient in a westerly direction, ultimately reaching the Ohio River.

Generally, the upper sediment layers in the study area are comprised mostly of finer-sized silts and clays, while the deeper layers are predominantly coarser-grained sands and gravels (Figure 17). This is consistent with the findings of earlier investigations by the USGS and Commonwealth of Kentucky (HI Atlas HA-111).

As the above discussion indicates, the proper conditions exist for this formation to be a very good water bearing aquifer. The porosity of the saturated sands and gravels is about 20 percent (USGS WSP-1579). This allows for a large storage capacity within the aquifer. In fact, the saturated sands and gravels in the study area could potentially store approximately 60 billion gallons of water.

The localized hydrology is such that water is constantly moving in the system. Water enters the aquifer primarily through precipitation and artificial recharge from septic tanks and seepage pits and travels down gradient to the river. The bedrock serves as a relatively impermeable barrier which prevents flow from moving eastward, away from the river.

The annual average precipitation in the area is approximately 43 inches per year. (NOAA, 1979). It has been estimated that approximately 6 inches

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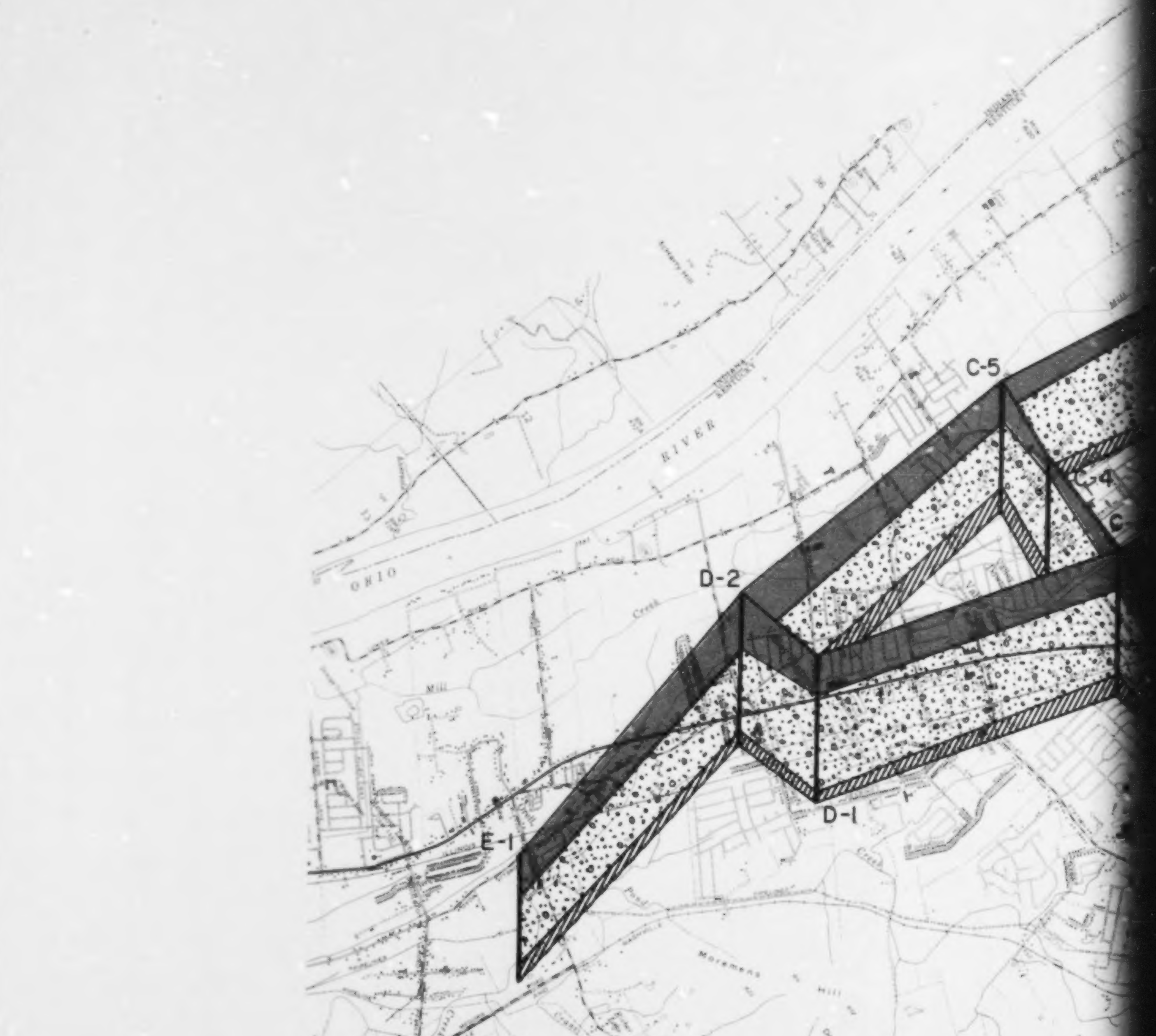
OHIO
RIVER
Mill
Creek
Moremens
Hill
C-5
C-4
D-2
D-1
E-1
LEGEND
■ CLAY OR SILT
▒ SAND OR GRAVEL
▨ BEDROCK

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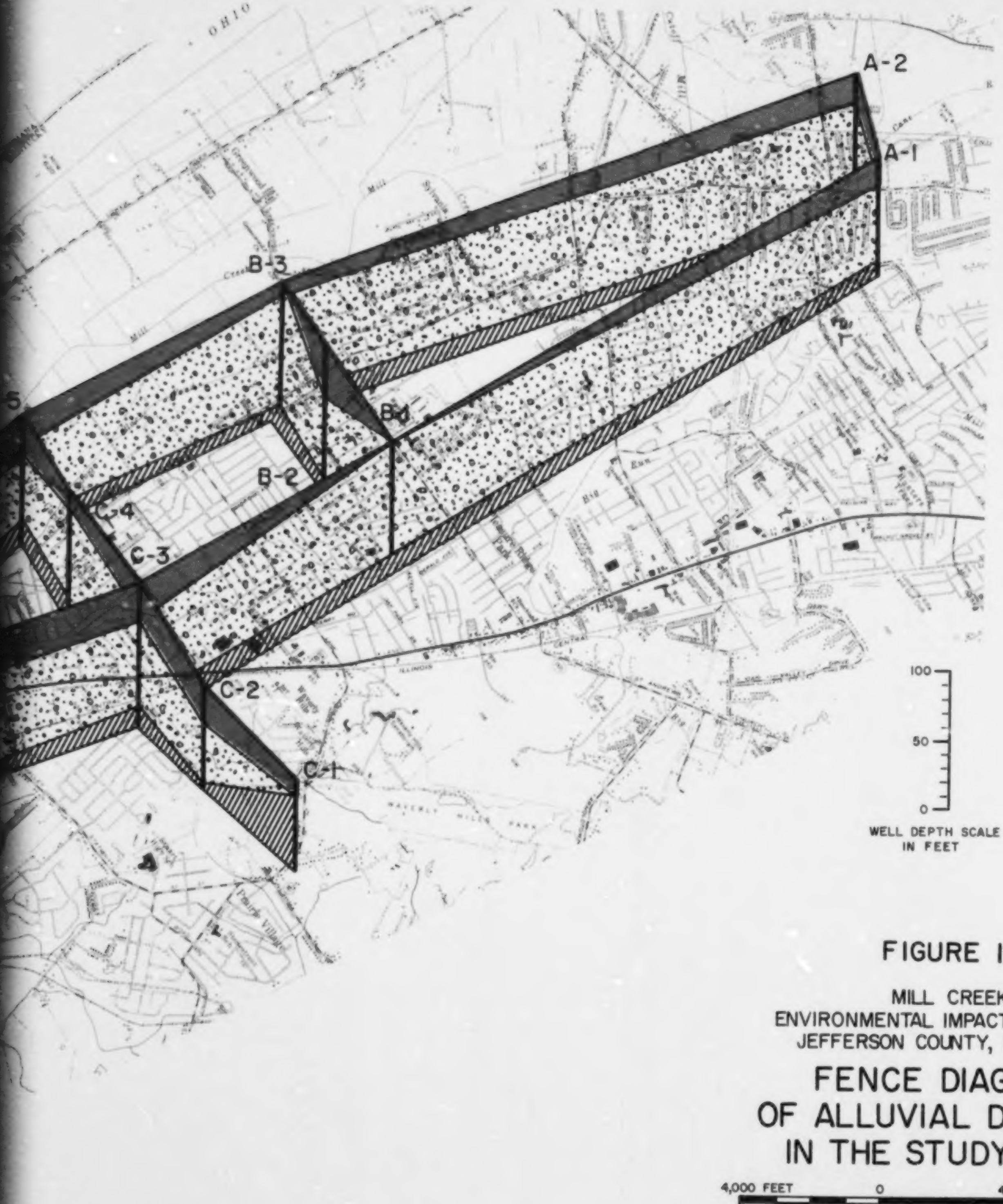

FIGURE 17

MILL CREEK
ENVIRONMENTAL IMPACT STATEMENT
JEFFERSON COUNTY, KENTUCKY

FENCE DIAGRAM OF ALLUVIAL DEPOSITS IN THE STUDY AREA

4,000 FEET 0 4,000 8,000
1,200 METERS 0 1,200 2,400

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per year of precipitation enters the aquifer from the surface (USGS C-276). An evaluation of the variations in gradient indicates that the groundwater flow velocity may vary from less than 2 feet per day to perhaps as much as 10 feet per day in some portions of the study area. All of the water flows to the river/aquifer boundary. In the study area, there is a good hydraulic connection between the river and the alluvium (USGS WSP 1819C). This means that there is almost unimpeded flow from the aquifer into the river, under conditions of normal river stage.

The picture that has been developed in the above discussion shows that the aquifer stores a large volume of water that is readily accessible for use throughout the study area. Furthermore, due to the local climatic pattern, losses to the river are replenished by precipitation.

Groundwater Quality

Historical water quality data for the Mill Creek area are limited. Most data sources are either records of short duration or contain numerous gaps. Concurrent data records are not extensive, and few comparisons between wells for the same years could be made. Generally, chloride concentrations and specific conductance have risen over the length of record. No discernible trends could be established for nitrate or iron. It was therefore determined that the historical record was not adequate to provide a clear indication of the quality of the aquifer.

The shortage of information regarding Mill Creek area groundwater quality brought about the development of the EIS groundwater program. In order to provide a comprehensive, reliable basis for conclusions, a two-phase groundwater investigation program was developed for the EIS.

Phase 1 Investigations

The first phase investigations involved the one-time sampling of about 100 existing private wells in the study area. This canvass sampling was planned with several objectives:

1. An overall picture of general groundwater quality could be determined fairly quickly.
2. Particular problem areas might be identified.
3. Appropriate parameters for analysis in future sampling could be identified.

Sampling and analysis were carried out in December, 1978. The Phase 1 work effort was planned as a rapid, relatively inexpensive sampling program to meet the objectives described above.

Although specific knowledge of well depths, well age, casing and screen material, and well condition was not acquired, it is probably a valid assumption that the 102 wells that were sampled are screened at a varity of depths. Thus, Phase 1 results may be accepted as "order of magnitude" indications of groundwater quality.

Phase 1 samples were analyzed for the following constituents:

1. Nitrate nitrogen
2. Ammonia nitrogen
3. Total phosphorus
4. Chloride
5. Conductivity
6. Total iron
7. Fecal coliform
8. Fecal streptococci

Brief summaries of findings are presented here to provide an understanding of the development of the second phase of the groundwater program.

Nitrate concentrations were found to range from less than 0.01 mg/l as N to 9.4 mg/l as N. While no groundwater sample exhibited nitrate at a concentration exceeding the federal standard for finished drinking water (10 mg/l as N), several of the samples contained nitrate at levels which suggested the presence of wastewater in certain areas.

Ammonia, fecal bacteria, and iron were found in several samples, but appeared to be unrelated to any particular locality or cultural feature. These pollutants were thought to be related to specific problems with individual wells. Total phosphorus, conductivity, and chloride results were inconclusive.

At the time of Phase 1 sampling, the general quality of Mill Creek groundwater appeared to satisfy federal standards for finished drinking water. Occurrence of standard violations probably reflected deficiencies of specific wells rather than a more widespread problem. However, the relatively high nitrate concentrations observed in several of the samples indicated the possibilty of a more widespread wastewater influence on the groundwater. On the basis of canvass sampling results, it was decided to proceed with a comprehensive, controlled sampling program to characterize groundwater quality and identify pollutant sources.

Phase 2 Investigations

Limitations of the Phase 1 groundwater program disallowed the development of specific conclusions regarding the quality of groundwater in the Mill Creek study area. Phase 1 results did, however, recommend additional, formalized sampling and analysis of area groundwater in order to verify or refute the general observations developed in the canvass sampling. The Phase 2 groundwater program was planned to meet several objectives:

1. To provide statistically reliable data, from several months of sampling, which would characterize the quality of groundwater throughout the Mill Creek study area.
2. To provide data regarding the short term (month-to-month) changes in groundwater depth and quality parameters.
3. To provide data from which the effects on groundwater of various cultural activities might be deduced.

General Approach

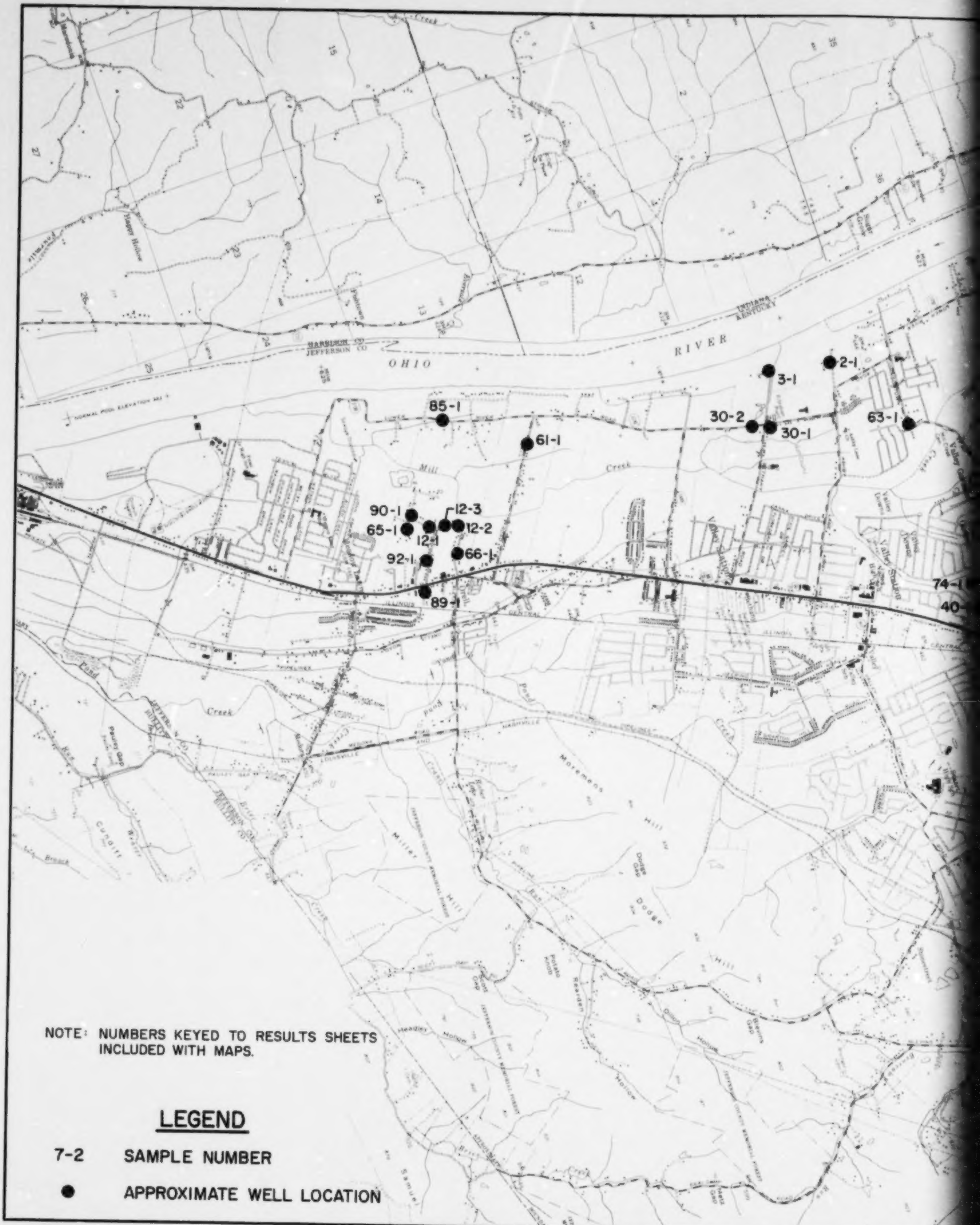
The sampling well network was developed to provide access to groundwater at various depths at many different locations in the study area. Further, sets of wells were arranged to intercept groundwater generally along a flow path from the east toward the Ohio River, to provide insight into the progressive effects of land surface activities on subsurface water as it flows toward the river. Well sites were generally provided with three separate wells: one established just above bedrock, (deep well - "d"), one established several feet below the water table observed at the time of drilling (shallow well - "s"), and a third established midway between the other two (middle well - "m").

Well Site Locations

Locations of well sites are presented on Figure 18. Sites A-1 and A-2 were established to intercept groundwater up-gradient and down-gradient from the residential areas known as the Idle Hour and the Cane Run Road subdivisions. These sampling points were established in part to determine what effects, if any, industrial activity in the northern portion of the study area has on groundwater quality. Site A-1 consists of three separate wells (A-1-s, A-1-m, A-1-d), as does site A-2 (A-2-s, A-2-m, A-2-d).

Well sites B-1, B-2, and B-3 were established along Greenwood Road. Land use between sites B-1, B-2, and B-3 is single family residential. All three well sites consist of three separate wells (B-1-s, B-1-m, B-1-d, B-2-s, B-2-m, B-2-d, B-3-s, B-3-m, B-3-d).

Well sites C-1, C-2, C-3, C-4, and C-5 were established along an east-west line represented by Johnsontown Road and its projection eastward from Dixie Highway. Site C-1 is the easternmost sampling position in the study area. Depth to bedrock was found to be relatively shallow, and only one well (C-1) was established. Site C-2 consists of two wells (C-2-s, C-2-d) established just to the east of Dixie Highway. Land use between site C-1 and C-2 is largely undeveloped. Residential development, as it exists, is served by sanitary sewers. Well site C-3, established in the easement of the "600"



NOTE: NUMBERS KEYED TO RESULTS SHEETS INCLUDED WITH MAPS.

LEGEND

7-2	SAMPLE NUMBER
●	APPROXIMATE WELL LOCATION

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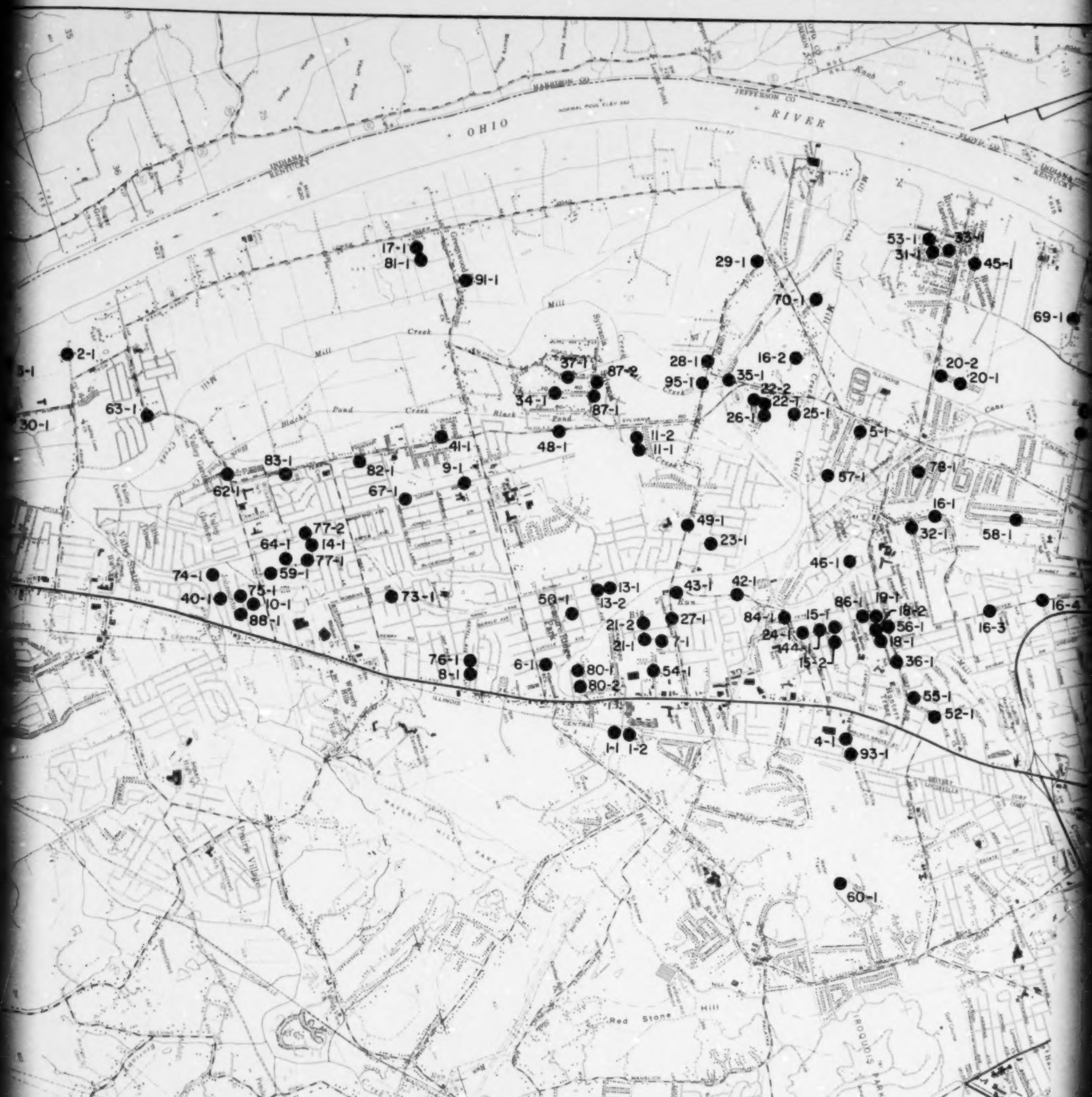

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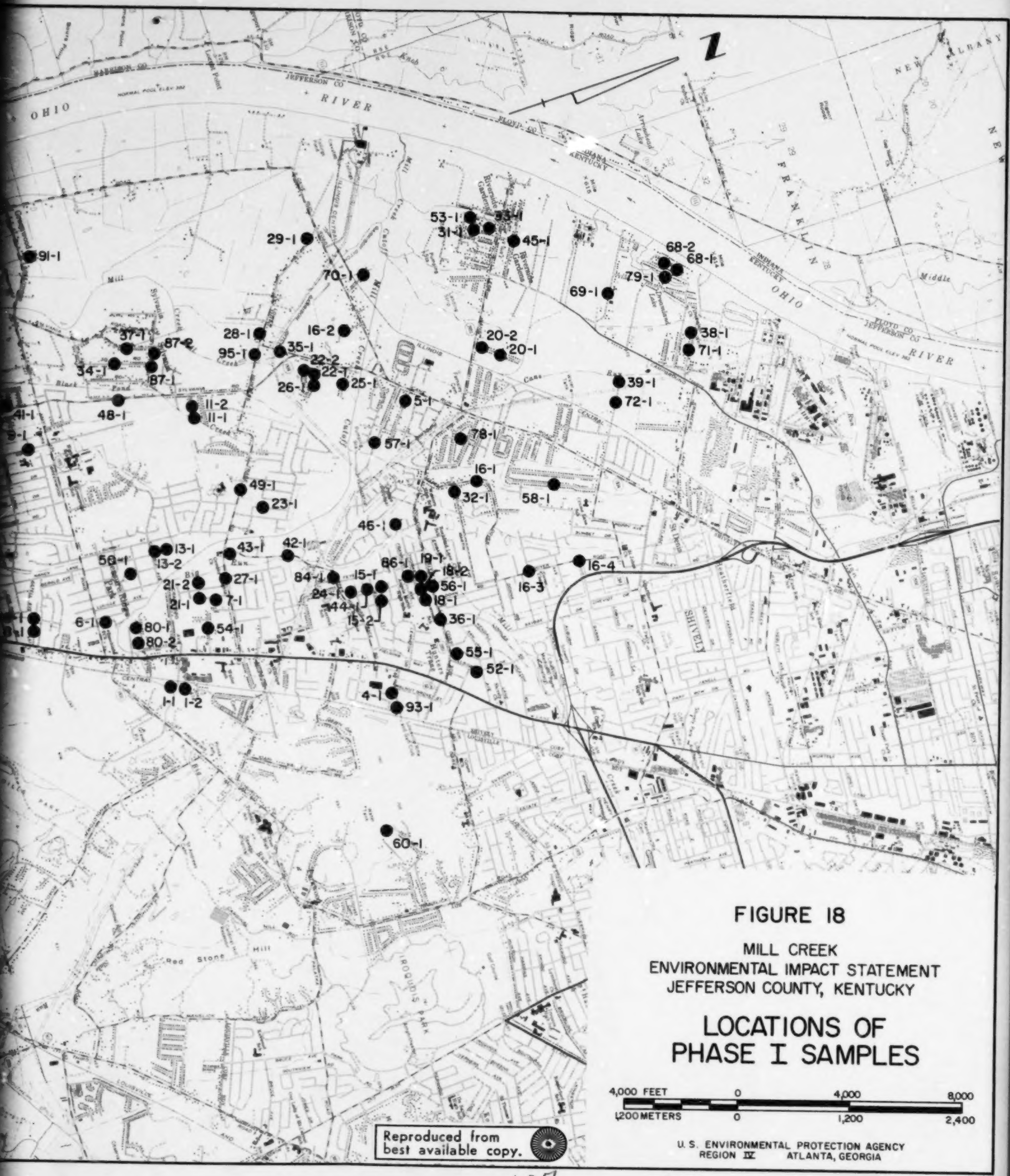

FIGURE 18

MILL CREEK
ENVIRONMENTAL IMPACT STATEMENT
JEFFERSON COUNTY, KENTUCKY

LOCATIONS OF
PHASE I SAMPLES

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tributary at Johnsontown Road, consists of three wells (C-3-s, C-3-m, C-3-d). Site C-4, at Black Pond Creek and Johnsontown Road, also consists of three wells (C-4-s, C-4-m, C-4-d). Land use between sites C-2, C-3, and C-4 is predominately single family residential. Well site C-5 consists of three wells (C-5-s, C-5-m, C-5-d) at Mill Creek and Johnsontown Road. Land use between sites C-4 and C-5 is generally undeveloped or agricultural.

Well sites D-1 and D-2 each consist of three wells (D-1-s, D-1-m, D-1-d, D-2-s, D-2-m, D-2-d), established to intercept groundwater up and down-gradient from the single family residential area (Valley Downs subdivision) between the sites.

The southernmost sampling site, E-1, consists of three wells (E-1-s, E-1-m, E-1-d) established at Orell Road and Old Orell Road.

Sampling Parameters

Tables 23, 24, and 25 list the parameters sampled and the sampling schedule for Phase 2 of the groundwater program.

Groundwater Program Summary and Conclusions

The findings of the groundwater investigations are summarized below:

1. Fluoride concentrations suggesting the presence of seepage pit effluent have been detected in many of the wells screened at bedrock.

2. Fecal coliform organisms have been detected in all Phase 2 wells at least one time during the investigation. Consistent fecal coliform presence has been detected in many wells, including several wells screened at bedrock.

3. High nitrate levels have been detected in several shallow Phase 2 wells. Several shallow well samples have exhibited nitrate levels higher than the federal standard for finished drinking water.

4. Chemical constituent concentrations have varied widely with time at several Phase 2 wells.

The major overall conclusion that is to be drawn from Phase 2 observations to date is that the Mill Creek portion of the Ohio River alluvial aquifer is influenced at all depths by wastewater from on-site disposal systems. Questions may be raised as to the sources of nitrate and fecal bacteria, and the suggestion that seepage pits represent the predominant source of these pollutants is based upon inference. The source of high fluoride levels observed in the medium and deep wells throughout the study area is most likely Louisville Water Company (LWC) water discharged to the aquifer through septic tank seepage pits. The widespread nature of high fluoride observations could not reasonably be assumed to result from water main leaks. Water leaks would be more likely to cause localized fluoride elevations, rather than the high concentrations observed throughout the study

TABLE 23. GROUNDWATER CONSTITUENTS
ANALYZED IN "ROUTINE ANALYSIS" (a)

Nitrate nitrogen

Chloride

Fluoride

Fecal coliform

Methylene blue active substances (MBAS (b))

(a) All wells were analyzed for these parameters every month of the groundwater program.

(b) MBAS is a nonspecific assay of surface active agents found in synthetic household detergents.

TABLE 24. INTERIM PRIMARY DRINKING WATER STANDARD CONSTITUENTS (a)

I. Inorganic constituents

- Arsenic
- Barium
- Cadmium
- Chromium
- Lead
- Mercury
- Nitrate nitrogen
- Selenium
- Silver

II. Pesticides, herbicides

- Endrin
- Lindane
- Methoxychlor
- Toxaphene
- 2, 4-D
- 2, 4, 5 - TP Silvex

(a) Wells A-2-s, B-2-s, C-3-s, D-2-s, and E-1-s were analyzed for these parameters each month of the groundwater program.

TABLE 25. EPA "PRIORITY POLLUTANTS" (a)

Chlorinated Alkanes
Methyl Chloride
Methylene Chloride
Methyl Bromide
Chloroform
Bromoform
Carbon Tetrachloride
Dichlorobromomethane
Trichlorofluoromethane
Dichlorodifluromethane
Chlorodibromomethane
Chloroethane
1,1-Dichloroethane
1,2-Dichloroethane
1,1,1-Trichloroethane
1,1,2-Trichloroethane
1,1,2,2-Tetrachloroethane
Hexachloroethane
1,1-Dichloroethylene
1,2-trans-Dichloroethylene
1,2-Dichloropropane
1,2-Dichloropropylene
Trichloroethylene
Tetrachloroethylene
Vinyl Chloride
Hexachlorobutadiene
Hexachlorocyclopentadiene

Chlorinated Aromatics
1,2,4-Trichlorobenzene
Chlorobenzene
Hexachlorobenzene
2-Chloronaphthalene
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene

Chlorinated Ethers
bis(Chloromethyl) Ether
2-Chloroethyl Vinyl Ether
4-Bromophenyl Phenyl Ether
bis(2-Chloroethoxy) Methane
bis(2-Chloroethyl) Ether
4-Chlorophenyl Phenyl Ether
bis(2-Chloroisopropyl) Ether

Aromatics
Benzene
Toluene
Ethylbenzene
Ethylbenzene
Naphthalene
Fluoranthene
Acenaphthene
Benzo(a) Anthracene
Benzo(a) Pyrene
Chrysene
Indeno(1,2,3-c,d)pyrene
3,4-Benzofluoranthene
Benzo(K)fluoranthene
Acenaphythylene
Anthracene
Benzo(ghi)perylene
Fluorene
Phenanthene
Dibenzo(a,h)anthracene
Pyrene

Phthalate Esters
bis(2-ethylhexyl)phthalate
Butyl Benzyl Phthalate
Di-n-butyl Phthalate
Di-n-octyl Phthalate
Diethyl Phthalate
Dimethyl Phthalate

Phenols
Phenol
2-Chlorophenol
2,4-Dichlorophenol
Pentachlorophenol
2-Nitrophenol
2,4-Dimethylphenol
4-Nitrophenol
2,4-Dinitrophenol
4,6-Dinitrophenol
4,6-Dinitro-o-cresol
2,4,6-Trichlorophenol
para-Chloro-meta-Cresol

Substituted Aromatics
Nitrobenzene
2,4-Dinitrotoluene
2,6-Dinitrotoluene
2,3,7,8-Tetrachlorodibenzo-p-Dioxin
Benzidine
3,3-Dichlorobenzidene
1,2-Diphenyl Hydrazine

TABLE 25. (CONT.)

Polychlorinated Biphenyls

PCB-1242
PCB-1221
PCB-1260
PCB-1254
PCB-1232
PCB-1016
PCB-1248

Miscellaneous

Acrolein
Acrylonitrile
Asbestos
Cyanide
Isophorone
N-Nitrosodimethylamine
N-Nitrosodiphyenylamine
N-Nitrosodi-n-propylamine

Pesticides

Aldrin
Dieldrin
Chlordane
4,4-DDT
4,4-DDE
4,4-DDD
a-Endosulfan-alpha
b-Endosulfan-beta
Endosulfan Sulfate
Endrin
Endrin Aldehyde
Heptachlor
Heptachlor Epoxide
e-BHC - Alpha
b-BHC - Beta
r-BHC(Lindane)-Gamma
g-BHC - Delta
Toxaphene

Metals

Antimony
Arsenic
Beryllium
Cadmium
Chromium
Copper
Lead
Mercury
Nickel
Selenium
Silver
Thallium
Zinc

(a) The following sampling schedule indicates the month and well sampled for these parameters:

A-2-s 9/79, 11/79, 2/80
A-2-d 4/80
B-2-s 9/79
C-3-s 11/79
D-2-s 2/80

area. Water use outside the home, such as lawn watering, could not reasonably be considered as the cause of fluoride peaks observed in deep wells in late October and early November. It is also unlikely that external uses throughout the study area at any time of year are more than a small fraction of total water use in the area.

If the aquifer is influenced at all depths by wastewater from on-site wastewater disposal systems, then it is unsuitable for use as a source of untreated drinking water. Several characteristics of the aquifer suggest that the wastewater influences observed in Mill Creek area groundwater might eventually be reduced if wastewater inputs were removed. The Mill Creek portion of the aquifer receives continuous recharge of essentially clean rainwater. The good hydraulic connection of the saturated zone with the Ohio River allows for continuous, slow flushing of pollutants introduced into the groundwater. The observations from month to month in Phase 2 investigations supports the suggestion that, given time, pollutant washout may occur.

The data collected to date do not provide ready answers to all questions regarding the effects of wastewater disposal practices on Mill Creek groundwater. The wide fluctuations of groundwater quality with time, especially in the deeper wells, indicates that the aquifer level at which wastewater may be detected is highly dependent on climatic conditions. Detailed characteristics of aquifer response to precipitation would require modeling of groundwater hydraulics.

From the public health perspective, the quality of Mill Creek area groundwater, as measured by the nitrate-nitrogen and fecal coliform data, are of greatest concern. Tables 26 and 27 summarize the groundwater program results for these parameters to allow for a greater understanding of the relative quality of these groundwaters.

Fauna

The health of the aquatic communities can be expected to reflect the quality of the water. Pond Creek, which drains the area east of the Mill Creek basin, exhibits consistent violations of standards for dissolved oxygen, dissolved solids, and fecal coliform and total coliform bacteria. The impacts on the aquatic communities from the poor water quality are compounded by the increased stream discharge and habitat destruction caused by increased urban runoff and stream alterations. Conditions in Mill Creek are very similar to those in Pond Creek. For example, much of Mill Creek has been channelized and stabilized with concrete. The water quality, land use patterns, and pollution sources for the study area are summarized in other sections. Their influence, however, is reflected in the composition and structure of the aquatic communities.

Fish

The fish fauna of the Ohio River has been described extensively. Clay (1975) in The Fishes of Kentucky has identified 201 species of fish in the state. Of these, well over half include the Ohio River in their range. A

TABLE 26. RESULTS OF THE EIS GROUNDWATER PROGRAM: NITRATES

LOW READING - 0.05 mg/l
HIGH READING - 17.70 mg/l

11 out of 403 samples exceeded 10 mg/l
shallow wells - 8 samples
medium wells - 3 samples
deep wells - 0 samples

Number of samples less than 1 mg/l - 305
Number of samples between 1-4.9 mg/l - 61
Number of samples 5-9.9 mg/l - 26
Number of samples over 10 mg/l - 11

Average reading of all 403 samples - 1.5 mg/l
Average reading of shallow wells - 3.1 mg/l
Average reading of medium wells - 1.0 mg/l
Average reading deep wells - 0.3 mg/l

Average readings by sampling period (8/79-7/80)
1 - 2.5 mg/l
2 - 1.8 mg/l
3 - 1.5 mg/l
4 - 1.0 mg/l
5 - 2.2 mg/l
6 - 1.8 mg/l
7 - 1.5 mg/l
8 - 2.1 mg/l
9 - 0.9 mg/l
10 - 0.7 mg/l
11 - 0.9 mg/l
12 - 0.8 mg/l

Average readings by well (in mg/l):
A-1-s - 3.6
A-1-m - 0.4
A-1-d - 0.8
A-2-s - 6.0
A-2-m - 0.3
A-2-d - 0.5
B-1-s - DRY
B-1-m - 5.6
B-1-d - 0.4
B-2-s - 4.9
B-2-m - 1.7
B-2-d - 0.2
B-3-s - 0.8
B-3-m - 0.5
B-3-d - 0.2
C-1-s - 1.2
C-2-s - DRY
C-2-d - 0.2
C-3-s - 3.4
C-3-m - 0.4
C-3-d - 0.2
C-4-s - 3.6
C-4-m - 0.5
C-4-d - 0.2
C-5-s - 4.2
C-5-m - 0.6
C-5-d - 0.3
D-1-s - 0.3
D-1-m - 0.2
D-1-d - 0.2
D-2-s - 0.3
D-2-m - 0.3
D-2-d - 0.3
E-1-s - 5.5
E-1-m - 0.2
E-1-d - 0.3

Note: First two characters refer to well site location. The third character (s, m, d) refers to well depth (shallow, mid-depth, or deep well, respectively).

TABLE 27. RESULTS OF THE EIS GROUNDWATER PROGRAM: FECAL COLIFORM

LOW READING - 0 #/ml
HIGH READING - 18,000 #/ml

Number of samples with 0 #/ml - 261
Number of samples between 1-10 #/ml - 46
Number of samples between 11-100 #/ml - 66
Number of samples between 101-1,000 #/ml - 22
Number of samples between 1001-10,000 #/ml -7
Number of samples over 10,000 #/ml - 1

Average reading of all 403 samples - 111
Average reading of shallow wells - 222
Average reading of medium wells - 64
Average reading deep wells - 43

Average readings by sampling period (8/79-7/80)

1 - 110 #/ml
2 - 583 #/ml
3 - 359 #/ml
4 - 30 #/ml
5 - 178 #/ml
6 - 13 #/ml
7 - 0 #/ml
8 - 0 #/ml
9 - 3 #/ml
10 - 48 #/ml
11 - less than 1
12 - 8 #/ml

Average readings by well (in #/100 ml):

A-1-s - 174
A-1-m - 31
A-1-d - 52
A-2-s - 14
A-2-m - 121
A-2-d - 126
B-1-s - DRY
B-1-m - 53
B-1-d - 36
B-2-s - 30
B-2-m - 12
B-2-d - 3
B-3-s - 88
B-3-m - 227
B-3-d - 14
C-1-s - 9
C-2-s - DRY
C-2-d - 55
C-3-s - 9
C-3-m - 10
C-3-d - 209
C-4-s - L.T. 1*
C-4-m - 6
C-4-d - 13
C-5-s - 2
C-5-m - 7
C-5-d - 8
D-1-s - 17
D-1-m - 8
D-1-d - 12
D-2-s - 2092
D-2-m - 171
D-2-d - 59
E-1-s - 8
E-1-m - 61
E-1-d - 38

*L.T. 1 - less than 1

Note: First two characters refer to well site location. The third character (s, m, d) refers to well depth (shallow, mid-depth, or deep well, respectively).

study by the Ohio River Valley Water Sanitation Commission (ORSANCO 1962) identified 130 species from the Ohio River. These relatively recent studies have indicated substantial changes in the fish fauna when compared to earlier works. These community changes have been influenced by increased pollution and the construction of dams on the river.

The study most directly applicable to the Mill Creek area is that of Terhune (1975) on Beargrass Creek. This creek drains eastern Louisville, where land use patterns are similar to those in the Mill Creek area, and has water quality similar to that of several streams in the Mill Creek area. The hydrologic regime of Beargrass Creek is also similar to that of streams in the Mill Creek area, consisting of greatly increased discharge following storm events and periods of little or no flow in late summer and fall. Terhune (1975) found 21 species of fish (Table 28); several species were found in the relatively unpolluted headwaters, but not in the downstream areas. The composition of the fish community in many of the streams in the Mill Creek EIS study area can be expected to parallel that of Beargrass Creek.

Shellfish

The most recent study of shellfish in the study area is that of Williams (1969). Williams details the historical use of the mussel fisheries in the Tennessee, Green, and Ohio Rivers and describes the three-year investigation of the effects of intensive harvesting of these mussels.

The EIS study area includes a portion of the Ohio River running from approximately River Mile 613 to River Mile 630. This section of the river is near the downstream end of Area III sampled by Williams (RM 538 to RM 648). Within the EIS study area Williams located two shellfish beds (RM 614.1 to RM 617.5 and RM 625.9 to RM 627.0), both on the Indiana side of the river. The species and number of individuals collected in Area III are summarized in Table 29.

Williams noted several factors that are having major negative impacts on the mussel population: overfishing, dredging, burial by shifting sandbars, and pollution. Mussels are relatively intolerant of pollution, and mussel communities subject to pollution usually have low species diversity and are dominated by pollution-tolerant species. While no data are available on the shellfish communities for the other surface streams in the study area, they have undoubtedly been severely impacted by the hydraulic modifications, urban runoff, and point-source pollution of these streams.

Other Invertebrates

Detailed studies of the invertebrate community (exclusive of shellfish) in the study area are extremely limited. The wide variation in the environmental conditions of the major streams in the area precludes any discussion of a common, "normal" invertebrate community. The pool-like habitat of the Ohio River is distinct from the floodplain sections of Pond or Mill Creeks which, in turn, are distinct from several of their faster, steeper-sloped tributaries.

The majority of the study area streams receive heavy pollution loadings and experience extreme variations in discharge from storm events. Invertebrate species that exist under these environmental conditions must be

TABLE 28. FISH COLLECTED FROM BEARGRASS CREEK, 1972-73

Scientific Name	Common Name
Clupeidae	
Dorosoma cepedianum	Gizzard shad
Cyprinidae	
Campostoma anomalum	Stoneroller
Cyprinus carpio	Carp
Ericymba buccata	Silverjaw minnow
Notropis ardens	Rosefin shiner
Notropis atherinoides	Emerald shiner
Notropis cornutus	Common shiner
Notropis spilopterus	Spotfin shiner
Pimephales notatus	Bluntnose minnow
Rhinichthys artratulus	Blacknose dace
Semotilus atromaculatus	Creek chub
Ictaluridae	
Ictalurus notatus	Yellow bullhead
Ictalurus punctatus	Channel catfish
Cyprinodontidae	
Fundulus notatus	Blackstripe topminnow
Poeciliidae	
Gambusia affinis	Mosquitofish
Centrarchidae	
Lepomis humilis *	Orangespotted sunfish
Lepomis macrochirus	Bluegill
Lepomis megalotis *	Longear sunfish
Percidae	
Etheostoma blennioides *	Greenside darter
Etheostoma flabellare *	Fantail darter
Etheostoma nigrum *	Johnny darter

Source: Terhune (1975).

* Species found only in unpolluted headwaters.

TABLE 29. SHELLFISH COLLECTED FROM THE OHIO RIVER BETWEEN RIVER MILE 538 AND RIVER MILE 648

Species	Number
Quadrula quadrula* - Maple leaf	114
Quadrula metanevra* - Monkey face	42
Quadrula nodulata - Wasty back	28
Quadrula pustulosa - White Pimpleback	57
Pleurobema cordatum* - Pigtoe	58
Pleurobema pyramidatum* - Pigtoe	103
Pleurobema coccineum - Round Pigtoe	1
Fusconaia ebenus* - Niggerhead	139
Fusconaia subrotunda - Long Solid	1
Fusconaia flavia - Wabash Pigtoe	7
Amblema costata* - Three Ridge	188
Megalonaias gigantea* - Washboard	31
Elliptio crassidens - Mule Ear	55
Obliquaria reflexa - Three Horn	27
Plagiola lineolata - Butterfly	2
Tritogonia verrucosa - Pistol Grip	17
Proptera alata - Pink Heel Splitter	7
Plethobasus cyphyus - Bullhead	2
Obovaria olivaria - Eggshell	1
Cyclonaias tuberculata - Pink Pimpleback	5
Leptodea laevissima - Papershell	1

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* Commercially valuable mussels
Source: Williams (1969)

pollution tolerant and adapted to withstand increased stream velocity and habitat destruction. Increasing urban and industrial development within the study area have led to increasing point and non-point pollution. These increases are reflected in the community structure of the invertebrates. Terhune (1975) has documented the effects of such development for the Beargrass Creek drainage basin. These effects include decreases in the number and diversity of invertebrate species with an increase in the percentage of pollution-tolerant species. The development of the Beargrass Creek basin has been similar to several streams in the study area including Pond Creek. The effects of this development have been confirmed for Pond Creek (Raven 1971). Analysis of benthic samples revealed poor biological conditions as indicated by the presence of pollution-tolerant organisms and the lack of pollution-intolerant organisms.

Protected Species

Currently, the protection of rare or endangered species in Kentucky is restricted to those species on the federal protection list. Previously, additional protection had been provided by state statute, but the state list was revised to include only those species on the federal lists.

The Louisville crayfish (*Orconectes jeffersoni*, Rhoades) was proposed for the Federal Endangered Species List in 1977, but is on neither the federal nor the state list at this time. Its range is restricted to Jefferson and Bullitt Counties, Kentucky. The type locality for the crayfish is a tributary to Muddy Fork of Beargrass Creek, although Fitzpatrick (1967) reported that the species could not be found at this site during field investigations in 1963 and 1964. The species has been collected from Knob Creek, a tributary stream for Pond Creek outside the study area (Fitzpatrick 1967).

Although the Louisville crayfish has been collected from surrounding drainage basins, there is no evidence of the species being present in the study area. Like many crayfish species, the Louisville crayfish is difficult to identify, requiring first-form, mature, adult males. Whether *O. jeffersoni* lives in the study area can only be answered with a detailed field study. However, the species is apparently sensitive to siltation and pollution and, as such, probably does not occur in the study area.

Flora

The Mill Creek study area lies within a broad vegetation region described as the Western Mesophytic Forest by Brown (1950). This forest region is described as a complex mosaic of vegetation not characterized by a single climax forest type. Climax vegetation appears to be transitional between the Mixed Mesophytic Forest (codominated by basswood, beech, buckeye, sugar maple, oaks, and tulip tree) to the east and the drier Oak-Hickory Forest to the west. Site-specific factors, such as soils, topography, and geology, with their resultant influences on moisture availability, determine which forest type is more closely resembled.

Topographic Influences

Although all of the study area was originally woodland, very little of the area remains forested today. The composition and extent of the present vegetation is largely determined by two distinct landforms that dominate the study area. Extending marginally into the northeastern part of the area is an upland section known as the Knobs. This area of varied topography rises as much as 90 m (300 ft) above the nearby lowlands, reaching a maximum elevation (within the study area) of 232 m (761 ft) at Iroquois Park. The rugged aspect of this upland area has prevented extensive development, and large tracts of forest remain there today. But even in these locations the forests are largely modified or second growth, with Iroquois Park being one of the few areas containing "any degree of natural forest" (KIPDA 1978).

Vegetation of the upland section was studied by a review of published literature on the area and a field examination of forest composition in and around Iroquois Park. In a recent discussion of the forests of the Knobs, Gunn (1966) identified two general plant communities: Oak and Oak-Hickory forests of the uplands, and Beech-Maple-Tulip-tree forests of the valleys.

Field examinations in the upland area revealed two intergrading plant communities. Forests on the upper slopes of Iroquois Park were mostly dominated by oaks, with white oak, chestnut oak, northern red oak, sugar maple, and ash in abundance. Also noted were hickory, elm, beech, basswood, red maple, and redbud. Lower slopes and more mesic areas (areas requiring a moderate amount of moisture) around Iroquois Park were found to be codominated by tulip tree and sweetgum. Other important species observed were ash, elm, beech, black walnut, and sycamore.

Occupying the remainder of the study area is a lowland landform largely coincident with the floodplains of the Ohio River and its tributaries. Topography within the lowland is generally very level with elevations gently rising from 130 m (420 ft) near the Ohio River to 150 m (500 ft) at the base of the Knobs. Forested areas are very limited in extent throughout the lowland, being primarily present as narrow bands adjacent to Mill Creek and its tributaries. The clearing of forests in this area is the result of agricultural and urban development. The fertile, level soils covering most of this section formerly facilitated intensive cropping of the area, with the main crops being corn, soybeans, hay, and vegetables (U.S. SCS 1966). More recently, urbanization has spread into the area, with residences accounting for most of this development.

Although a review of botanical literature discovered no ecological descriptions of undisturbed bottomland forests in the study region, a fairly detailed vegetational survey of the lowland section of the study area was recently conducted by Vollmer-Presnell-Pavlo (VPP 1976). Although many of the forested areas were successionally young stands, most of the mature trees (30-cm (12-in.) diameter at breast height (dbh) or larger) identified in the lowland area were species that have been characterized as typical of moist sites and bottomlands (U.S. Forest Service 1965; U.S. ACE 1978).

Rare, Threatened, and Endangered Species

No plant species currently listed on the Federal Register as threatened or endangered are known to occur in Kentucky. However, 28 plants from Kentucky have been proposed for inclusion on the federal list, and an additional 34 species are considered rare, threatened, or endangered within the state by the Kentucky Fish and Wildlife Office (Stephens and Durell 1979). Of these species, only one, the swamp cottonwood (*Populus heterophylla*), has been found to occur within the study area boundaries. The field survey by VPP (1976) discovered swamp cottonwood stands in wet areas of the lowland section along Mill Creek and some of its tributaries. Although the tree is considered rare in Kentucky, this is probably because the state is a peripheral area in the range of the species. Since this species is not listed, and has not been proposed to be listed on the Federal Register, it is not legally protected or likely to be in the near future. The proper habitat conditions for many of the species proposed for inclusion on the federal end may exist in the study area. Swampy woods, bottomlands, alluvial thickets, and low woods can be found in the lowland section; and moist, wooded slopes, rich woods, and hillsides can be found in the upland section. However, the existence of proper habitat conditions does not necessarily indicate the probable presence of any of these species, since they are all known to be rare. Regardless of the presence of these plants, none are currently afforded legal protection.

Wetlands

Wetlands are defined as "those areas that are inundated or saturated by ground or surface water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (U.S. ACE 1978). Because of its situation in the floodplain of the Ohio River, the lowland section of the study area is likely to have contained many wetland areas before the area was settled. Draining and filling wetlands for agriculture and urban growth, however, has eliminated most of the wet areas within the study area. Many wetlands were "reclaimed" in the past when they were suspected of fostering yellow fever and cholera epidemics (KIPDA 1978). Studies of the Riverport area by the Louisville District of the Army Corps of Engineers found a few narrow wetlands along stream channels, but none of them is over 2 ha (5 ac) (U.S. ACE 1980). Furthermore, the Kentucky Nature Preserves Commission has no records of any substantial wetlands in the study area (Harker 1980).

Climate

The climate of the study area is a modified continental type. Louisville is located in the mid-latitudes, in the belt of westerly winds, and in the path of cyclonic and anti-cyclonic storms. The area's climate is influenced by moisture generated in the Gulf of Mexico region. Winter Continental Polar air masses and summer Maritime Tropical air masses combine to produce sharp contrasts between summer and winter weather. Minor variations of weather also occur within the major summer and winter trends because of the movement of high-space and low-pressure systems across the study area. Occasional cold and hot spells are quickly moderated as the pressure systems move out.

Climatic characteristics of Jefferson County are summarized below:

Wind	Prevailing direction	Southerly
	Average velocity	16 km/m (10 mph)
Temperature	Mean annual	14°C (57°F)
	Coldest month	January
	Warmest month	July
Precipitation	Average rainfall	107 cm (42 in.) per year

Weather conditions in the Mill Creek area are primarily influenced by topography and differ only in degree, and not scale, from regional weather patterns. The study area lies within the valley of the Ohio River and is bordered on the east and west by high ridges. This enclosure causes noticeable variations in heating, cooling, and wind movements between this and other portions of the Louisville area. The ridge of low hills immediately west of the study area on the Indiana side of the Ohio River acts as a partial barrier to westerly winds and arctic blasts. Snow is frequently observed on the summits of these hills when none exists in the study area.

Air Quality

The Louisville/Jefferson County area has a long history of air pollution problems. In 1952 the Kentucky State Legislature passed enabling legislation that authorized the establishment of the Jefferson County Air Pollution Control District, an outgrowth of the previous Smoke Commission. The purpose of the Air Pollution Control District was to reduce air pollution in order to safeguard life, health, property, and public welfare. This agency eventually became the Air Pollution Control Board and currently operates under Federal as well as State legislation. The Air Pollution Control Board currently maintains three air pollution monitoring sites in the Mill Creek area: Terry Road at Sander's Elementary School, Dixie Highway at Pendleton Road, and 10200 Dixie Highway.

The air over Jefferson County violates federal air quality standards for sulfur dioxide, particulate matter, carbon monoxide, lead, and ozone. The Mill Creek study area has localized problems of air quality violations for all of these pollutants. Carbon monoxide, lead, and particulate matter are generally related to transportation activities. Air Pollution Control Board records indicate that the Dixie Highway corridor is severely impacted by these pollutants. Sulfur dioxide is more a function of industrial activity and occurs with greatest frequency and magnitude within the northern industrialized portions of the study area.

5.2.2 Effects of the Alternatives on the Natural Environment

Each of the feasible wastewater treatment alternatives (2, 6, 7, 8, 9) were evaluated for impact on the natural environment. This evaluation was performed in two phases: a descriptive analysis of the impact of each wastewater treatment system on each environmental parameter and a comparative assessment of the impact of each wastewater management alternative on the environment.

In general, the Mill Creek area has been drastically altered by man's activities, and very little, if any, of its environment can be considered "natural," in the sense of an undisturbed, pristine ecosystem. Near the Ohio River, the creeks have been straightened and even redirected to combat flooding, and the wetlands have been drained for agricultural uses. Farther upland from the river the land has been developed haphazardly in the suburban sprawl typical of most American metropolitan areas. Natural vegetation is limited to Iroquois Park and along the banks of some streams; wildlife habitat is generally poor except for species adaptable to the urban environment; and significant sensitive natural areas, such as wetlands or endangered-species habitat, do not exist or, at least, have not been identified. Very little specific information exists on the flora and fauna of this particular area, though, so much of the discussion of the environmental baseline and the environmental impacts is general. For example, the benthos of the area's streams has not been studied, but, given the presence of poorly treated wastewater and urban runoff, it is likely to comprise pollution-tolerant species. This was shown to be the case in Beargrass Creek, in eastern Louisville, and in Pond Creek, south of Louisville.

Primary Impacts

Initially, twelve environmental parameters were considered: geology, topography, air quality, climate, soils, odor, noise, vegetation, aquatic wildlife, terrestrial wildlife, surface waters, and groundwater. The first four of these parameterswould not be affected by any of the wastewater treatment alternatives, so they were deleted from further consideration. The remaining parameters were discussed individually to determine the impact of each alternative.

The primary impacts of each wastewateter treatment system--i.e., direct effects on the environment from the construction or operation of wastewater treatment facilities--are listed in Table 30. Each impact was assessed as to whether it would further degrade or improve the existing environment, how long it would be manifest, how much of study area it would affect, and what the degree or relative intensity of the impact would be. The duration of the impact was considered to be short-term if it were limited to the time of construction or an infrequent malfunction, and if the environment could recover to its previous condition once the insult was removed; long-term if it persisted throughout the operating lifetime of the treatment system, but could return to its previous condition if a different system were ultimately employed; and permanent if it were irreversible, no matter whether the action was continued or ended. The degree of the impact was assessed qualitatively as to whether it would represent a slight, moderate, or severe degradation of the environment, or whether it would be a slight, moderate, or great improvement.

The next step in the evaluation process involved assigning the impacts specified in Table 30 to the population components that constitute the system alternatives--1) the population that is currently sewered, 2) the population that is currently served by septic tanks, and 3) the future population--on the basis of which of the four treatment systems will be used by each component.

System Alternative 2a (Table 31)

The environmental impacts from alternative 2a are primarily associated with the discharge methods. Since the number of people on septic tank systems would increase, the quality of the groundwater would be influenced. If the small treatment plants were to switch to subsurface disposal, this influence would be increased, although the quality of the surface waters would increase. Even if the surface water discharges were continued, water quality would improve somewhat because the level of treatment would be higher. The effects of land application would be intermediate between these two. The surface water discharges would be removed, and the effects on groundwater would be reduced substantially by treatment in the soils.

TABLE 30. PRIMARY ENVIRONMENTAL IMPACTS OF WASTEWATER TREATMENT ALTERNATIVES

Environmental Parameter and Treatment Alternative	Impact Description	Adverse/ Beneficial	Duration of Impact	Magnitude of Impact	Degree of Impact
SOILS					
Septic tanks	Clogging of soil pores around seepage pits	Adverse	Long-term	Localized around seepage pits	Slight around most pits; more severe around poorly maintained systems
Alternative toilets	Clearing of soil pores where graywater replaces wastewater as septic-tank effluent	Beneficial	Long-term	Homes converted from septic tanks	Slight improvement around existing seepage pits
	Clogging of soil pores around new seepage pits	Adverse	Long-term	New homes	Very slight around most pits
Small WWTPs	Loss of soil due to erosion during expansion of plants and conveyance systems	Adverse	Permanent	Plant sites and limited stretches of new collectors	Moderate if good erosion-control practices used
With surface water discharge	No impact				
With subsurface discharge	Clogging of soil pores around seepage pits	Adverse	Long-term	Localized around seepage pits	Slight around all pits, more severe around poorly operated plants
With land application	Clogging of soil pores in disposal area	Adverse	Long-term	Land application sites	Slight in all systems; more severe in poorly operated systems
	Enhancement of soil fertility	Beneficial	Long-term	Land application sites	Moderate in all systems
Regional system	Clearing of soil pores around existing seepage pits	Beneficial	Long-term	Localized around seepage pits	Slight improvement
	Loss of soil due to erosion during construction of treatment plant and conveyance system	Adverse	Permanent	Plant site and extensive stretches of interceptors and collectors	Moderate if good erosion control practices are used
ODOR					
Septic tanks	Odor from failing systems	Adverse	Short-term	Localized around failing systems scattered throughout the area	Moderate
Alternative toilets	Odor from improperly composting waste	Adverse	Short-term	Confined to a few homes scattered throughout the area	Moderate
Small WWTPs	Odor from improperly operated plants	Adverse	Short-term	Immediate neighborhood of the improperly operating plants	Moderate
Regional system	Odor from improperly operated plant	Adverse	Short-term	Neighborhoods surrounding the plant	Moderate
NOISE					
Septic tanks	Not significant for existing systems				
	Construction noise during conversion in presently sewered areas	Adverse	Short-term	Throughout sewered areas	Severe at times
Alternative toilets	Not significant during operation				
	Construction noise during conversion of present population	Adverse	Short-term	Throughout presently developed areas	Severe at times
Small WWTPs	Construction noise during expansion of plants or placement of collector system	Adverse	Short-term	Narrow zones around construction areas	Severe at times
Regional system	Construction noise during construction of plant and placement of interceptors and collectors	Adverse	Short-term	Narrow zones around construction areas	Severe at times
VEGETATION					
Septic tanks	Temporary loss of ornamentals during installation	Adverse	Short-term	Sewered areas converted to septic tanks	Moderate, but reversible
Alternative toilets	Temporary loss of ornamentals during installation of disposal system	Adverse	Short-term	Sewered areas converted to alternative toilets	Moderate, but reversible
Small WWTPs	Temporary loss of vegetation during placement of new collectors	Adverse	Short-term	Collector system rights-of-way	Moderate, but reversible
	Change in community on land application sites	Either	Long-term	Land application sites	Moderate to severe/great improvement
Regional system	Temporary loss of vegetation during placement of interceptors and collectors	Adverse	Short-term	Collection system rights-of-way	Moderate, but reversible
TERRESTRIAL WILDLIFE					
Septic tanks	Not significant				
Alternative toilets	No impact				
Small WWTPs	Loss of microhabitat during placement of new collectors	Adverse	Short-term	Collector system rights-of-way	Very severe, but reversible in most cases
	Change in community due to change in habitat on land application sites	Either	Long-term	Land application sites	Moderate to severe/great improvement
Regional WWTPs	Loss of microhabitat during placement of interceptors and collectors	Adverse	Short-term	Conveyance system right-of-way	Very severe, but reversible in most cases

TABLE 30. (Continued)

Environmental Parameter and Treatment Alternative	Impact Description	Adverse/ Beneficial	Duration of Impact	Magnitude of Impact	Degree of Impact
AQUATIC WILDLIFE					
Septic tanks	If existing WWTPs were abandoned, increased diversity in biological community downstream of plants	Beneficial	Long-term	Streams below small WWTPs	Very great improvement
Alternative toilets	If existing WWTPs were abandoned, increased diversity in biological community downstream of plants	Beneficial	Long-term	Streams below small WWTPs	Very great improvement
Small WWTPs	Destruction of benthic community during installation of new collectors	Adverse	Short-term	Small zones at stream crossings	Very severe, but reversible
Surface water discharge	Increased diversity in biological community downstream of treatment plant discharge due to higher effluent quality	Beneficial	Long-term	Streams below small WWTPs	Moderate if flows remain constant, slight if flows increase
	Disruption of biological community due to shock pollutant load during plant malfunctions	Adverse	Short-term	Streams below small WWTPs	Very severe, but reversible
Subsurface discharge	Increased diversity in biological communities due to removal of effluent from streams	Beneficial	Long-term	Streams below small WWTPs	Very great improvement
Land application	Increased diversity in biological communities due to removal of effluent from streams, a small amount of runoff may still enter streams	Beneficial	Long-term	Streams below small WWTPs	Great improvement
Regional system	Increased diversity in biological communities downstream of abandoned WWTPs	Beneficial	Long-term	Streams below small WWTPs	Very great improvement
	Decreased diversity in biological community of Ohio River	Adverse	Long-term	Relatively small effluent-mixing zone downstream of discharge	Slight; degradation moderated by size of Ohio River
	Disruption of biological community of Ohio River due to shock pollutant load during plant malfunction	Adverse	Short-term	Effluent-mixing zone	Moderate; impact moderated by dilution with Ohio River water
	Destruction of benthic community during installation of interceptors and collectors	Adverse	Short-term	Small zones at numerous stream crossings	Very severe, but reversible
SURFACE WATERS					
Septic tanks	Improved water quality in streams, if existing small WWTPs are abandoned, otherwise, no impact	Beneficial	Long-term	Streams below small WWTPs	Very great improvement
Alternative toilets	Improved water quality in streams, if existing small WWTPs are abandoned, otherwise, no impact	Beneficial	Long-term	Streams below small WWTPs	Very great improvement
Small WWTPs	Siltation of streams during placement of interceptors along streams and construction of stream crossings	Adverse	Short-term	Limited segments of streams along new interceptor routes and at stream crossings	Moderate; only during periods of erosion or in-stream construction
Surface water discharge	Improved water quality in streams due to higher effluent quality	Beneficial	Long-term	Streams below small WWTPs	Moderate if flows remain constant, slight if flows increase
	Temporary violations of water quality standards due to shock pollutant loading during plant malfunctions	Adverse	Short-term	Streams below small WWTPs	Very severe, but reversible
Subsurface discharge	Improved water quality in streams due to removal of discharges	Beneficial	Long-term	Streams below small WWTPs	Very great improvement
Land application	Improved water quality in streams due to removal of discharges, a small amount of runoff may still enter streams	Beneficial	Long-term	Streams below small WWTPs	Great improvement
Regional system	Improved water quality in streams due to removal of discharges	Beneficial	Long-term	Streams below small WWTPs	Very great improvement
	Degraded water quality in Ohio River	Adverse	Long-term	Relatively small effluent-mixing zone downstream of discharge	Slight; degradation moderated by dilution with Ohio River water
	Further degradation of water quality in Ohio River during plant malfunctions	Adverse	Short-term	Effluent-mixing zone	Moderate; impact moderated by dilution with Ohio River water
	Siltation of streams during placement of interceptors along streams and construction of stream crossings	Adverse	Short-term	Extensive stretches of streams along new interceptors and numerous stream crossings	Moderate; only during periods of erosion or in-stream construction
GROUNDWATER					
Septic tanks	Continued influence of groundwater from existing systems; increased influence from new systems	Adverse	Long-term	Entire study-area aquifer	Slight to moderate, due to use
Small WWTPs					
Surface water discharge	No impact				
Subsurface discharge	Increased pollution of groundwater	Adverse	Long-term	Entire study-area aquifer	Moderate, due to use
Land application	Increased pollution of groundwater by percolation of effluent through disposal area	Adverse	Long-term	Entire study-area aquifer	Slight to moderate
Regional system	No further pollution of groundwater; existing pollutants gradually flushed out	Beneficial	Long-term	Entire study-area aquifer	Very great improvement

TABLE 31. ENVIRONMENTAL ANALYSIS OF SYSTEM ALTERNATIVE 2a

Category of Impact	Population Presently Served By Small Treatment Plants				Population Presently Served By Septic Tanks				Future Population			
	none	minor	moderate	significant	none	minor	moderate	significant	none	minor	moderate	significant
Soils	○-S	●-SS ●-L			○					●		
Odor		●-S ●-SS ●-L				●				●		
Noise		●-S ●-SS ●-L			○				○			
Vegetation		●-S ●-SS	●-L		○				○			
Aquatic Wildlife			●-S ☆-L	☆-SS	○				○			
Terr. Wildlife	○-S	●-SS		●-L	○				○			
Surface Waters			●-S ☆-L	☆-SS	○				○			
Ground Water	○-S	●-L	●-SS				●				●	

KEY: ○-No Impact, ●-Adverse Impact, ☆-Beneficial Impact, S-Small WWTP with surface water discharge, SS-Small WWTP with subsurface discharge, L-Small WWTP with land discharge.

System Alternative 2b (Table 32)

To a large extent the impacts of alternative 2b are the same as those of 2a. The major difference involves the construction of collector systems in those areas presently on septic tanks but in the natural drainage area of a small treatment plant. Such construction would cause temporary noise and loss of vegetation in those neighborhoods and would result in some siltation of streams from constructing sewers along and across those streams. The quality of the groundwater would be improved to the extent that seepage pit discharge is replaced by surface water discharge or land application. Surface water quality, on the other hand, would be further impacted by larger discharges, although the quality of those discharges would be improved.

System Alternative 6 (Table 33)

The most beneficial impact of the regional alternative is the removal of virtually all wastewater discharges to the study area's groundwater and streams. The streams would still be degraded, to some extent, by urban runoff, but the aquifer would be gradually flushed and the groundwater would approach a more natural condition.

Negative impacts occur from major construction activities of sewer lines and the initiation of a new discharge to the Ohio River. Construction of the interceptors would cause major noise impacts, major transportation impacts, siltation in adjacent streams, and loss of vegetation. The Ohio River is large enough to accept the discharge from the regional plant with minimal effect. Temporary violations could occur if major disruptions of plant service do occur, but again the relatively large flow of the Ohio would minimize the impact of the discharge.

System Alternative 7a (Table 34)

To the extent that alternative 7a relieves existing small treatment plants in the eastern half of the study area, the water quality of those streams will improve. Some, if not all, of that improvement will be negated by surface water discharges of future plants. The new discharge to the Ohio will be smaller than that discussed for alternative 6, so the impacts will be even less. There will be a temporary disruption of streams and neighborhoods as the sewer lines for the limited regional system are constructed. The current condition of the groundwater will not change because the number of septic tank systems will not change, although the groundwater would be further influenced if subsurface discharges occurred from future small treatment plants.

System Alternative 7b (Table 35)

Because there would be no new, small treatment plants, the quality of the streams would increase below the relieved package plants. Groundwater would be further influenced as future development would be served by septic tank systems.

System Alternative 7c (Table 36)

Because there would be no new, small wastewater treatment plants, the quality of the streams would increase below the relieved package plants.

TABLE 32. ENVIRONMENTAL ANALYSIS OF SYSTEM ALTERNATIVE 2b

Category of Impact	Population Presently Served By Small Treatment Plants				Population Presently Served By Septic Tanks				Future Population			
	none	minor	moderate	significant	none	minor	moderate	significant	none	minor	moderate	significant
Soils	○-S	●-SS ●-L			○-S ○-ST	●-SS ●-L			○-S	●-SS ●-L ●-ST		
Odor		●-S ●-SS ●-L				●-S ●-SS ●-L ●-ST				●-S ●-SS ●-L ●-ST		
Noise		●-S ●-SS ●-L			○-ST	●-S ●-SS ●-L			○-ST	●-S ●-SS ●-L		
Vegetation		●-S ●-SS	●-L		○-ST		●-S ●-SS ●-L		○-ST		●-S ●-SS ●-L	
Aquatic Wildlife			●-S ☆-L	☆-SS	○-ST	●-S	☆-L	☆-SS	○-ST	●-S	☆-L	☆-SS
Terr. Wildlife	○-S	●-SS		●-L	○-ST	●-S ●-SS	●-L		○-ST	●-S ●-SS	●-L	
Surface Waters			●-S ☆-L	☆-SS	○-ST		☆-L ●-S	☆-SS	○-ST		☆-L ●-S	☆-SS
Ground Water	○-S	●-L	●-SS			☆-S ●-L	●-SS ●-ST		○-S	●-L	●-SS ●-ST	

KEY: ○-No Impact, ●-Adverse Impact, ☆-Beneficial Impact, ST-Septic Tanks, S-Small WWTP with surface water discharge, SS-Small WWTP with subsurface discharge, L-Small WWTP with land discharge.

TABLE 33. ENVIRONMENTAL ANALYSIS OF SYSTEM ALTERNATIVE 6

Category of Impact	Population Presently Served By Small Treatment Plants				Population Presently Served By Septic Tanks				Future Population			
	none	minor	moderate	significant	none	minor	moderate	significant	none	minor	moderate	significant
Soils		●				☆ ●				●		
Odor		●				●				●		
Noise		●					●			●		
Vegetation		●				●				●		
Aquatic Wildlife		●-OS		☆		●-OS				●-OS		
Terr. Wildlife		●					●				●	
Surface Waters		●-OS		☆		●-OS				●-OS		
Ground Water	○						☆		○			

KEY: ○-No Impact, ●-Adverse Impact, ☆-Beneficial Impact, OS-Impact occurs outside of study area.

TABLE 34. ENVIRONMENTAL ANALYSIS OF SYSTEM ALTERNATIVE 7a

Category of Impact	Population Presently Served By Small Treatment Plants				Population Presently Served By Septic Tanks				Future Population			
	none	minor	moderate	significant	none	minor	moderate	significant	none	minor	moderate	significant
Soils	○-S	●-SS ●-L ●-RP			○				○-S	●-SS ●-L ●-RP		
Odor		●-S ●-SS ●-L	●-RP			●				●-S ●-SS ●-L	●-RP	
Noise		●-S ●-SS ●-L ●-RP			○					●-S ●-SS ●-L ●-RP		
Vegetation		●-S ●-SS ●-RP	●-L		○					●-RP	●-S ●-SS	●-L
Aquatic Wildlife		●-RP OS	●-S ☆-L	☆-SS ☆-RP	○					●-RP	●-S ☆-L	☆-SS
Terr. Wildlife	○-S	●-SS ●-RP		●-L	○					●-S ●-SS	●-RP	●-L
Surface Waters		●-RP OS	●-S ☆-L	☆-SS ☆-RP	○					●-RP	☆-L	●-S ☆-SS
Ground Water	○-S ○-RP	●-L	●-SS				●		○-S ○-RP	●-L	●-SS	

KEY: ○-No Impact, ●-Adverse Impact, ☆-Beneficial Impact, S-Small WWTP with surface water discharge, SS-Small WWTP with subsurface discharge, L-Small WWTP with land discharge, RP-Regional WWTP, OS-Impact occurs outside of study area.

TABLE 35. ENVIRONMENTAL ANALYSIS OF SYSTEM ALTERNATIVE 7b

Category of Impact	Population Presently Served By Small Treatment Plants				Population Presently Served By Septic Tanks				Future Population			
	none	minor	moderate	significant	none	minor	moderate	significant	none	minor	moderate	significant
Soils	○-S	●-SS ●-L ●-RP			○					●		
Odor		●-S ●-SS ●-L	●-RP			●				●		
Noise		●-S ●-SS ●-L ●-RP			○				○			
Vegetation		●-S ●-SS ●-RP	●-L		○				○			
Aquatic Wildlife		●-RP OS	●-S ☆-L	☆-SS ☆-RP	○				○			
Terr. Wildlife	○-S	●-SS ●-RP		●-L	○				○			
Surface Waters		●-RP OS	●-S ☆-L	☆-SS ☆-RP	○				○			
Ground Water	○-S ○-RP	●-L	●-SS				●				●	

KEY: ○-No Impact, ●-Adverse Impact, ☆-Beneficial Impact, S-Small WWTP with surface water discharge, SS-Small WWTP with subsurface discharge, L-Small WWTP with land discharge, RP-Regional WWTP, OS-Impact occurs outside of study area.

TABLE 36. ENVIRONMENTAL ANALYSIS OF SYSTEM ALTERNATIVE 7c

Category of Impact	Population Presently Served By Small Treatment Plants				Population Presently Served By Septic Tanks				Future Population			
	none	minor	moderate	significant	none	minor	moderate	significant	none	minor	moderate	significant
Soils	○-S	●-SS ●-L ●-RP			○					●		
Odor		●-S ●-SS ●-L	●-RP			●				●		
Noise		●-S ●-SS ●-L ●-RP			○					●		
Vegetation		●-S ●-SS ●-RP	●-L		○					●		
Aquatic Wildlife		●-RP OS	●-S ☆-L	☆-SS ☆-RP	○					●-OS		
Terr. Wildlife	○-S	●-SS ●-RP		●-L	○						●	
Surface Waters		●-RP OS	●-S ☆-L	☆-SS ☆-RP	○					●-OS		
Ground Water	○-S ○-RP	●-L	●-SS				●		○			

KEY: ○-No Impact, ●-Adverse Impact, ☆-Beneficial Impact, S-Small WWTP with surface water discharge, SS-Small WWTP with subsurface discharge, L-Small WWTP with land discharge, RP-Regional WWTP, OS-Impact occurs outside of study area.

Groundwater quality would still be impacted by existing on-site systems. Since capacity would be provided in the Dixie Highway Interceptor, future development would be served by either the proposed Dixie Highway Interceptor or the existing Black Pond Interceptor.

It should be noted that alternative 7c represents the first phase of what could ultimately be the regional system. The environmental analysis of alternative 6 would then be applicable for the future components.

System Alternative 8 (Table 37)

Alternative 8 represents the first phase of the 201 plan regional system. The environmental analysis for phase 1 is therefore similar to alternative 7c and would ultimately be similar to alternative 6.

System Alternative 9 (Table 38)

With increased numbers of small treatment plants, either the groundwater or the surface waters will be further degraded, depending on the discharge method. If subsurface discharges are used, groundwater quality would be degraded because all of the area's wastewater will be discharged to the aquifer. If surface water discharges are used, the effects on the streams will be more severe than under alternative 7a, because there will be no relief of some of the existing plants. If land application is used, the groundwater will be influenced slightly and surface water would increase if the current discharges are removed. With any of the discharge methods, there will be temporary siltation of the streams during the construction of sewers.

Summary (Table 39)

In order to summarize the total impact of each system alternative, the impact magnitude for each population component from the individual matrices was appropriately weighted to form a summary matrix. The weighting of the population components is necessary because the system alternatives impact each population component differently and because the size of components is different:

Population presently served	approximately 20,000
Population presently served by septic tanks	approximately 70,000
Future population	approximately 40,000

Therefore, the greatest weight in determining overall impacts was given to those impacts associated with actions affecting the largest population component, those people presently served by septic tanks.

TABLE 37. ENVIRONMENTAL ANALYSIS OF SYSTEM ALTERNATIVE 8

Category of Impact	Population Presently Served By Small Treatment Plants				Population Presently Served By Septic Tanks				Future Population			
	none	minor	moderate	significant	none	minor	moderate	significant	none	minor	moderate	significant
Soils	○-S	●-SS ●-L ●-RP			○					●		
Odor		●-S ●-SS ●-L	●-RP			●				●		
Noise		●-S ●-SS ●-L ●-RP			○					●		
Vegetation		●-S ●-SS ●-RP	●-L		○					●		
Aquatic Wildlife		●-RP OS	●-S ☆-L	☆-SS ☆-RP	○					●-OS		
Terr. Wildlife	○-S	●-SS ●-RP		●-L	○						●	
Surface Waters		●-RP OS	●-S ☆-L	☆-SS ☆-RP	○					●-OS		
Ground Water	○-S ○-RP	●-L	●-SS				●		○			

KEY: ○-No Impact, ●-Adverse Impact, ☆-Beneficial Impact, S-Small WWTP with surface water discharge, SS-Small WWTP with subsurface discharge, L-Small WWTP with land discharge, RP-Regional WWTP, OS-Impact occurs outside of study area.

TABLE 38. ENVIRONMENTAL ANALYSIS OF SYSTEM ALTERNATIVE 9

Category of Impact	Population Presently Served By Small Treatment Plants				Population Presently Served By Septic Tanks				Future Population			
	none	minor	moderate	significant	none	minor	moderate	significant	none	minor	moderate	significant
Soils	○-S	●-SS ●-L			○				○-S	●-SS ●-L		
Odor		●-S ●-SS ●-L				●				●-S ●-SS ●-L		
Noise		●-S ●-SS ●-L			○					●-S ●-SS ●-L		
Vegetation		●-S ●-SS	●-L		○						●-S ●-SS	●-L
Aquatic Wildlife			●-S ☆-L	☆-SS	○						●-S ☆-L	☆-SS
Terr. Wildlife	○-S	●-SS		●-L	○					●-S ●-SS		●-L
Surface Waters			●-S ☆-L	☆-SS	○						☆-L	●-S ☆-SS
Ground Water	○-S	●-L	●-SS				●		○-S	●-L	●-SS	

KEY: ○-No Impact, ●-Adverse Impact, ☆-Beneficial Impact, S-Small WWTP with surface water discharge, SS-Small WWTP with subsurface discharge, L-Small WWTP with land discharge.

TABLE 39. SUMMARY OF THE ENVIRONMENTAL IMPACTS OF THE ALTERNATIVE WASTEWATER TREATMENT SYSTEMS

System Alternative	Soils	Odor	Noise	Vegetation	Terr. Wildlife	Aquatic Wildlife	Surface Waters	Ground Waters
1. All Septic Tanks	●	●	●	●	○	☆	☆	●●
2. Septic Tanks and								
a. Existing WWTPs								
i. Surface Water	●	●	●	●	○	●	●	●●
ii. Subsurface	●	●	●	●	●	☆	☆	●●
iii. Land	●	●	●	●	●	☆	☆	●●
b. Expanded WWTPs								
i. Surface Water	●	●	●	●●	●	●●	●●	●
ii. Subsurface	●	●	●	●●	●	☆☆	☆☆	●●
iii. Land	●	●	●	●●	●●	☆	☆	●
6. Regional System	●	●	●●	●	●●	●	●	☆☆
7. Limited Regional System and								
a. Small WWTPs								
i. Surface Water	●	●●	●	●	●	●	●	●●
ii. Subsurface	●	●●	●	●	●	☆☆	☆☆	●●
iii. Land	●	●●	●	●●	●●	☆	☆	●●
b. Septic Tanks	●	●	●	●	●	☆	☆	●●
c. Expanded Line	●	●	●	●	●	☆	☆	●
8. 1st Phase Regional	●	●	●●	●	●●	☆	☆	●
9. No-Action With:								
i. Surface Water	○	●	●	●	●	●	●●	●●
ii. Subsurface	●	●	●	●	●	☆☆	☆☆	●●
iii. Land	●	●	●	●●	●●	☆☆	☆☆	●

KEY:
No Overall Impact: ○
Adverse Impact: ●-Minor, ●●-Moderate, ●●●-Significant
Beneficial Impact: ☆-Minor, ☆☆-Moderate, ☆☆☆-Significant

Secondary Impacts

Secondary impacts are those environmental changes associated with population growth supported by the various wastewater management alternatives. Two scenarios could be projected for the extent of urbanization in the Mill Creek area during the planning period. The first would assume that the regional conveyance and treatment system (alternative 6) is built and that the area develops rapidly and to the maximum density permissible, both industrial and residential, under zoning regulations. The second scenario would assume that the regional system is not built and that any of the other treatment alternatives is practical, so that the area develops relatively more slowly and less densely.

It is likely that the difference in residential development, both magnitude and density, would be slight under the two general wastewater management scenarios. Alternative 6 would probably facilitate development, thus increasing the initial rate of development compared to the other alternatives. The current densely populated nature of most of the study area, which developed without benefit of a regional system, indicates, however, that the population magnitude and density at the end of the planning period would be essentially the same under under any system alternative. The secondary impacts, therefore, would be the same.

The implications of the two scenarios would be most significant for the area along Mill Creek that is presently sparsely developed and is mostly environmentally significant agricultural land. An interceptor along Mill Creek would facilitate industrial development in Riverport and other areas.

Regardless of its impetus, urbanization will have the following general impacts:

1. Loss of the usefulness of soil that is covered by buildings, roads, parking lots, etc. This is particularly critical in the area of environmentally significant agricultural land.
2. Loss of natural vegetation due to urban encroachment; i.e., lawns replace semi-natural grasslands; roads displace trees.
3. The loss of vegetation, in turn, means a loss of habitat for a diverse wildlife community.
4. Urban stormwater runoff dumps slug doses of pollutants, including some toxic metal and organic compounds, into the streams, lowering water quality.
5. Concomitantly, pollution-intolerant species are less likely to survive in the streams so the diversity of aquatic wildlife decreases.

In terms of the relative severity of these secondary impacts, urbanization of the prime agricultural land would be a permanent loss to the environment. The other impacts would cause only slight or moderate losses, because the study area is already urbanized to a great extent and significant communities of natural vegetation or wildlife are rare.

5.3 Man-Made Environment

5.3.1 Description

Population

Population projections for the study area were compiled by the Louisville and Jefferson County Metropolitan Sewer District (MSD) from KIPDA projections prepared in connection with areawide water quality management planning (208 Plan). KIPDA figures were disaggregated to the level of MSD drainage sub-basins to provide population projections for collector and interceptor sewer design. Residential populations in 1972 and those projected for 1995 are presented in Table 40 for the 58 Mill Creek subareas. The subarea populations were compiled by combining values for MSD sub-basins included in each subarea.

Recent actions by EPA and the Kentucky Department of Natural Resources and Environmental Protection on control populations for water quality and air quality planning has resulted in lower population projections for Jefferson County than those adopted for 208 water quality planning. The new populations were projected through 2000, with adjustmenent for preliminary 1980 census data, by the Urban Studies Center of the University of Louisville. These new population figures were made available late in the development of the Mill Creek Area EIS and have therefore not been factored fully into this report. For the purposes of comparison, the new figures can be developed by using the 208 Plan sub-basin percentages applied to the control population. Generally, this results in an overall 1995 county population reduction of 18 percent.

Socio-Economics

A large body of information concerning community economics, employment, housing, and demographics is available in the records of the U.S. Census Bureau. Several socio-economic characteristics of the study area are presented in Table 41. In each case, statistics for Jefferson County and "National Urban Areas" are provided for comparison.

In 1970 the population of the Mill Creek area was 99 percent white and younger than both County and national urban populations; it was composed largely of families with dependent children.

In 1969 median family income in the Mill Creek area was similar to the national urban median, but six percent higher than the County median. The poverty level was about one-half of the level in the County and national urban areas.

There is an approximately equal distribution of white-collar and blue-collar workers in the study area. It may be noted that the sums of "Percent white-collar workers, 1970" and "Percent blue-collar workers, 1970" is in excess of 100 percent for the Mill Creek area. The cause of this inconsistency could not be determined. Generally, it appears that slight shifts toward a larger proportion of white-collar workers occurred between 1960 and 1970. Such shifts conform to national trends. Unemployment in the study area in 1970 was approximately equal to that of the county and the nation.

TABLE 40. RESIDENTIAL AND INDUSTRIAL-EQUIVALENT POPULATIONS, FOR MILL CREEK SUBAREAS (a)

Subarea	1972 Residential Population	1995 Residential Population	1995 Industrial Equivalent Population	1995 Total Equivalent Population
1	1,212	1,548	5,892	7,440
2	995	1,126	480	1,606
3	2,267	2,680	660	3,340
4	2,034	2,364	3,348	5,712
5	1,299	1,640	0	1,640
6	1,599	2,042	0	2,042
7	1,310	1,685	108	1,793
8	2,038	2,107	0	2,107
9	1,540	1,821	0	1,821
10	772	772	0	772
11	547	602	0	602
12	317	837	0	837
13	336	675	0	675
14	243	589	0	589
15	494	805	0	805
16	1,632	2,406	0	2,406
17	1,956	2,789	0	2,789
18	1,681	2,275	0	2,275
19	2,825	3,721	0	3,721
20	2,865	3,240	264	3,504
21	3,796	3,960	0	3,960
22	1,675	9,825	252	10,077
23	1,406	1,771	870	2,641
24	1,651	1,668	0	1,668
25	1,561	2,938	0	2,938
26	2,807	2,828	0	2,828
27	3,136	4,147	0	4,147
28	2,778	2,835	1,070	3,905
29	4,026	4,363	0	4,363
30	2,736	3,269	0	3,269
31	2,187	3,123	0	3,123
32	4,030	4,334	0	4,334
33	1,268	1,304	0	1,304
34	3,512	3,816	0	3,816
35	4,443	3,896	0	3,896
36	381	631	2,917	3,548
37	386	942	0	942
38	1,536	2,354	0	2,354
39	728	1,170	1,202	2,372
40	622	1,712	0	1,712
41	176	482	48,240	48,722
42	666	666	34,032	34,698
43	1,043	1,062	7,940	9,002
44	183	638	9,813	10,451
45	0	627	23,791	24,418

TABLE 40. (CONT.)

Subarea	1972 Residential Population	1995 Residential Population	1995 Industrial Equivalent Population	1995 Total Equivalent Population
46	19	174	30,516	30,690
47	36	1,204	0	1,204
48	77	2,048	0	2,048
49	1,836	5,295	0	5,295
50	19	769	10,937	11,706
51	219	1,470	15,936	17,406
52	685	3,587	5,059	8,646
53	1,259	2,895	0	2,895
54	236	1,993	0	1,993
55	3,199	5,989	1,245	7,234
56	336	2,269	0	2,269
57	494	1,246	0	1,246
58	3,773	3,860	0	3,860
Total	86,486	134,532	226,269	360,801

(a) See Figure 8 for subarea locations.

TABLE 61. SOCIO-ECONOMIC CHARACTERISTICS OF MILL CREEK AREA

		Mill Creek Mean	Jefferson County Mean	Mean for National Urban Areas
Demographics (1970)	Percent black	0.9	13.8	13.2
	Percent 65 years and older	3.8	9.0	9.4
	Percent 18 years and younger			
	Dependency ratio (a)	42 65	37 46	35 45
Family Income (1969)	Median Income	$10,459	$ 9,819	$10,618
	Percent families below poverty level	4.8	8.9	8.3
	Percent persons below poverty level	5.7	11.7	11.1
Employment (1970)	Percent white collar workers	67	47	54
	Farm and blue collar workers	50	40	33
	Percent of labor force unemployed	4	4	4
Housing (1970)	Percent owner-occupied unit	80.1	62.0	55.[illegible]
	Percent units vacant	2.6	4.5	4.9
	Median value of owner-occupied units	$15,900	$15,400	$18,100
	Median persons per unit	3.4	2.7	3.0

(a) Dependency ratio is the number of persons 65 and older plus the number of persons 18 and younger, as a percentage of total population.

Houses in the Mill Creek area in 1970 were largely owner-occupied and were valued at about the County average. Few of the units were vacant, and the average number of persons in each unit was somewhat higher than the County average.

Land Use

Existing and future land use are important factors in wastewater management planning. The pattern and density of development have major implications for the type and location of wastewater collection, treatment, and disposal facilities. Both the 201 Water Quality Management Plan (KIPDA 1974) and the 208 Areawide Waste Treatment Management Plan (KIPDA 1978) addressed the topic of current and future land use. The land use analysis in the 208 Plan was developed by KIPDA in conjunction with the preparation of the Comprehensive Plan for Louisville and Jefferson County by LJCPC.

The Comprehensive Plan, adopted in 1979, was designed to be a policy statement that would guide development in Louisville and Jefferson County. The plan incorporates the following principles, among others:

1. Promotion of orderly growth so that new housing, jobs and services support anticipated population growth;
2. Enactment of government programs to strengthen and revitalize older areas in the community;
3. Preservation and better utilization of existing buildings and capital facilities, cultural resources, and the natural environment;
4. Restrictions on development in environmentally sensitive areas;
5. Compatibility between land uses with regard to density, transitions between uses, clustering of similar uses, and provisions of transportation modes other than the automobile.

In the Mill Creek study area, existing land use controls that support the above principles include a zoning ordinance, adopted in 1943, and subdivision regulations, adopted in 19[illegible]. These programs are administered by LJCPC. In addition, the Planning Commission has developed an extensive inventory of existing and projected land use characteristics in the County.

Data collected by the Planning Commission show that in 1973 the Mill Creek 201 study area was evenly divided between developed (49.6 percent) and undeveloped (50.4 percent) land uses. The areas of most intensive development were those between the Ohio River and the Dixie Highway Corridor.

Residential land uses account for 4,190 ha (10,356 ac) or 68.1 percent of developed land in the study area. The study area contains [illegible] dwelling units, which provide an average density of 8.48 units per ha (3.44 units per ac). Densities are considerably higher in the northern portion of the study area and correspondingly lower in the southern portion.

The EIS study area contains the second largest concentration of industrial development in the County--922 ha (2,278 ac). Industrial land uses are found along the Ohio River in the extreme northern and southern portions of the study area. As of 1975, no industrial parks were established in the study area, although the Riverport Industrial Park is currently under development. Major industrial employers include Airco Alloys & Carbide, B. F. Goodrich Chemicals Co., E. I. Du Pont De Nemours & Co., Rohn & Haas Kentucky, Inc., Stauffer Chemical Co., American Synthetic Rubber Corp., Kosmos Cement Co., and Reynolds Metals Co.

Commercial development is a function of population growth, and commercial facilities have followed migration outside the Louisville city limits. Commercial land uses now account for 728 ha (1,798 ac) or 11.8 percent of the developed land in the study area. Large concentrations of strip commercial development are found along Dixie Highway.

Open space uses are defined as parks, cemeteries, and cultural or entertainment uses. The study area contains 321 ha (792 ac) of open space, which represents 5.2 percent of the developed land.

Agricultural land, found mainly in the southern portion of the study area, account for 881 ha (2,176 ac) or 14.2 percent of vacant land. Much of the remaining undeveloped land is environmentally constrained because of its location in the 100-year floodplain, existing soil and geologic conditions, or slopes exceeding 12 percent.

Land use changes have been projected through 1995. Table 42 summarizes these changes in five-year increments, and includes the land use statistics for 1975. Developed land comprises single-family, multifamily, industrial, commercial and open space uses; vacant land includes undeveloped and agricultural areas. Between 1975 and 1995, developed land in the study area is projected to rise from 69 percent to 64 percent of the total land area. A detailed discussion of the methodologies used to make these projections may be found in the 208 *Areawide Waste Treatment Plan* (KIPDA 1978).

The Mill Creek study area is the fourth largest of the six developing basins in Jefferson County, but it is expected to have the second slowest growth rate over the next 20 years. The predominant land uses now and in the future will be residential and industrial, with high concentrations of commercial uses located along Dixie Highway.

Between 1975 and 1995, single-family land use is projected to rise from 3,977 ha (9,828 ac) to 4,649 ha (11,488 ac), a 17 percent increase. At the same time, multifamily land use is expected to rise from 213 ha (526 ac) to 437 ha (1,079 ac), a 105 percent increase. This projection is in line with the nationwide increase in multifamily residential construction as individuals are priced out of the single-family housing market because of rising land and labor costs.

Substantial industrial growth is anticipated in the study area. The industrial park at Riverport will contain approximately 306 developed hectares (757 ac). Other industrial development is expected to consume 228 ha (563 ac) over the next 20 years.

TABLE 42. SUMMARY OF FUTURE DEVELOPMENT TRENDS

Year	Single-family			Multi-family			Industrial			Commercial			Open Space		
	ha	ac	%	ha	ac	%	ha	ac	%	ha	ac	%	ha	ac	%
[illegible]	[illegible]	[illegible]	32	213	526	2	922	2,278	7	728	1,798	6	323	798	3
[illegible]	[illegible]	[illegible]	33	261	644	2	987	2,438	8	779	1,926	6	484	1,197	4
[illegible]	[illegible]	[illegible]	33	317	784	3	1,159	2,865	9	803	1,985	7	504	1,246	4
[illegible]	[illegible]	[illegible]	34	375	927	3	1,384	3,420	11	826	2,042	7	513	1,268	4
[illegible]	[illegible]	[illegible]	38	437	1,079	4	1,544	3,816	12	850	2,101	7	534	1,320	4

Commercial land use will increase from 728 ha (1,798 ac) in 1975 to 850 ha (2,101 ac) in 1995, a gain of 17 percent--identical to that of residential land use. Existing nodes of commercial development are expected to expand slightly with no new major retail or office uses.

Open space acreage is expected to increase from 321 ha (792 ac) to 537 ha (1,320 ac), a 67 percent gain. Most of the additional 214 ha (528 ac) of parkland will be required for neighborhood parks, with 26 ha (65 ac) allocated to community parks, 47 ha (115 ac) to major urban parks, and 15 ha (36 ac) to private parks.

Generalized land uses for 1975 and 1995 are illustrated in Figure 19.

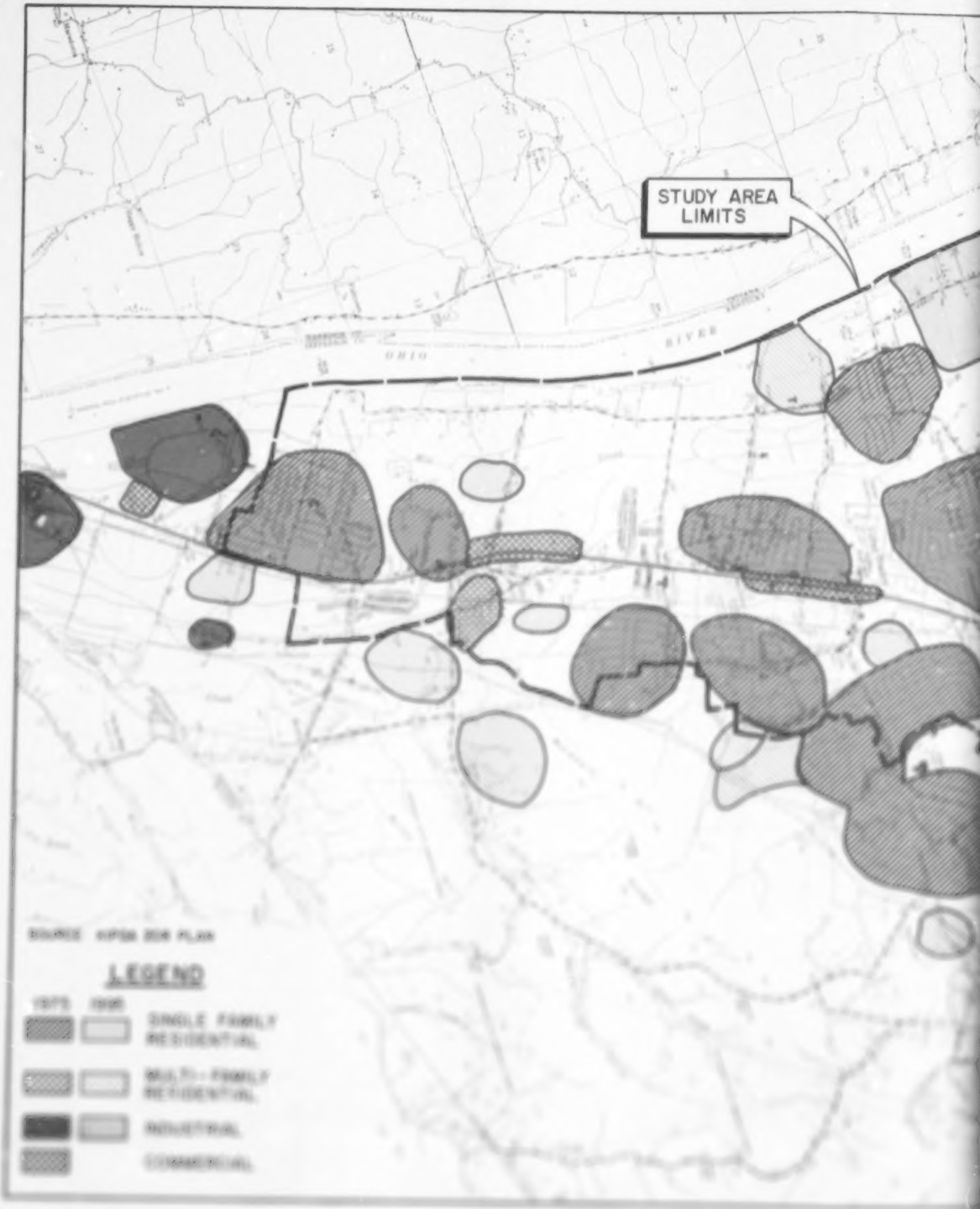
Significant Agricultural Land

The need to protect the nation's environmentally significant agricultural land from irreversible conversion to industrial or residential uses has been recognized by both EPA (1978) and the Council on Environmental Quality (1980). EPA has defined seven kinds of environmentally significant agricultural lands: prime farmland, unique farmland, additional farmland of statewide importance, additional farmland of local importance, farmland in or contiguous to environmentally sensitive areas, farmland of importance for waste utilization, and farmland with significant capital investment in best-management practices for non-point-source pollution control. The first four kinds of farmland, originally defined by the U.S. Department of Agriculture (7 CFR Part 657), have been mapped in Jefferson County by SCS. As shown in Figure 20, most of the undeveloped land in the study area has been designated as prime farmland; much of the rest has been classified as additional farmland of statewide importance. Prime farmland is defined by the Department of Agriculture as land having the best combination of soil quality, growing season, and moisture supply for producing high crop yields. Much of the prime farmland in the Mill Creek area is located on the 100-year floodplain of the Ohio River, so it also qualifies, under the U.S. EPA's expanded list, as farmland in or contiguous to environmentally sensitive areas. The land slated for development as the Riverport Industrial Complex is both prime farmland and floodplain.

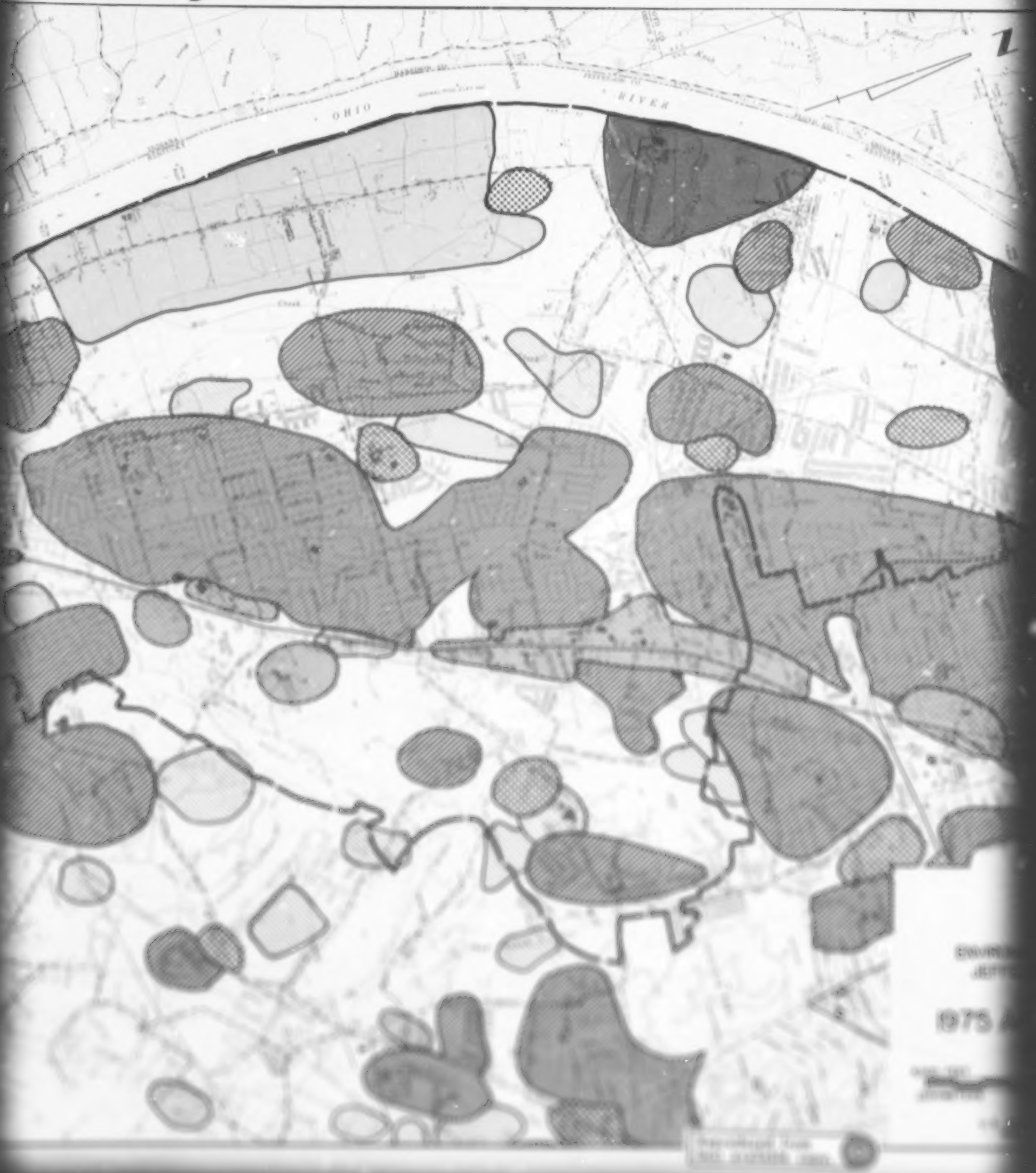
Water Supply

The earliest residents in the study area obtained water for domestic use from individual private wells dug down to the sand-and-gravel aquifer beneath the region. As population and housing density increased, a private water utility, the Louisville Extension Water District, was formed to provide water to many of the Mill Creek residents. The District established a well field and treatment and storage facilities at a site near Bethany Lane and Lower River Road, and conveyed chlorinated well water through a system of water mains to domestic and commercial customers. The Louisville Extension Water District was purchased by the Louisville Water Company (LWC) in [illegible], and the LWC continued the operation of the Lower River Road well field until late [illegible]. By early [illegible], all piped water in the study area was treated Ohio River water provided by the LWC.

A


STUDY AREA LIMITS
OHIO
RIVER
SOURCE: KIPDA 208 PLAN
LEGEND
1975
1995
SINGLE FAMILY RESIDENTIAL
MULTI-FAMILY RESIDENTIAL
INDUSTRIAL
COMMERCIAL

B



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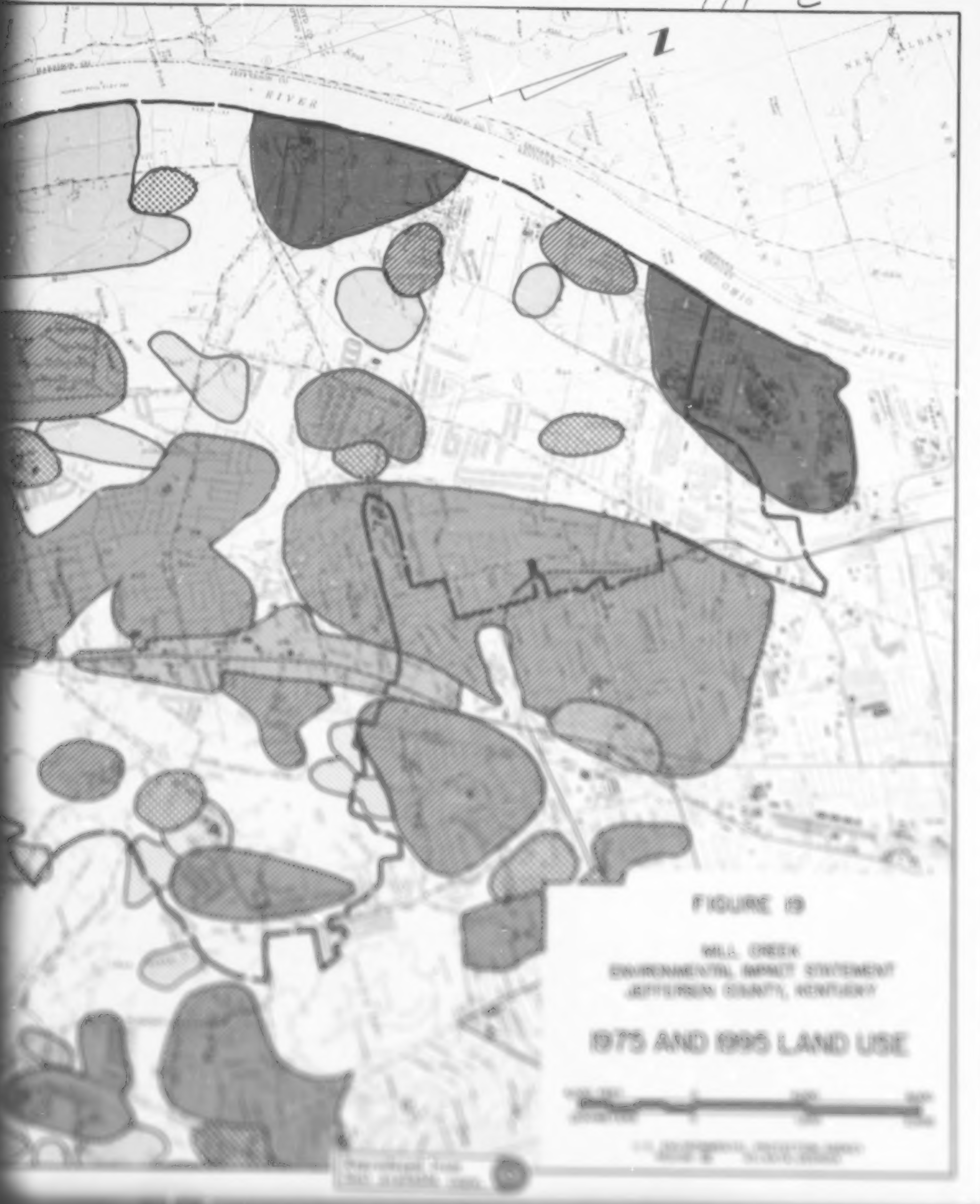
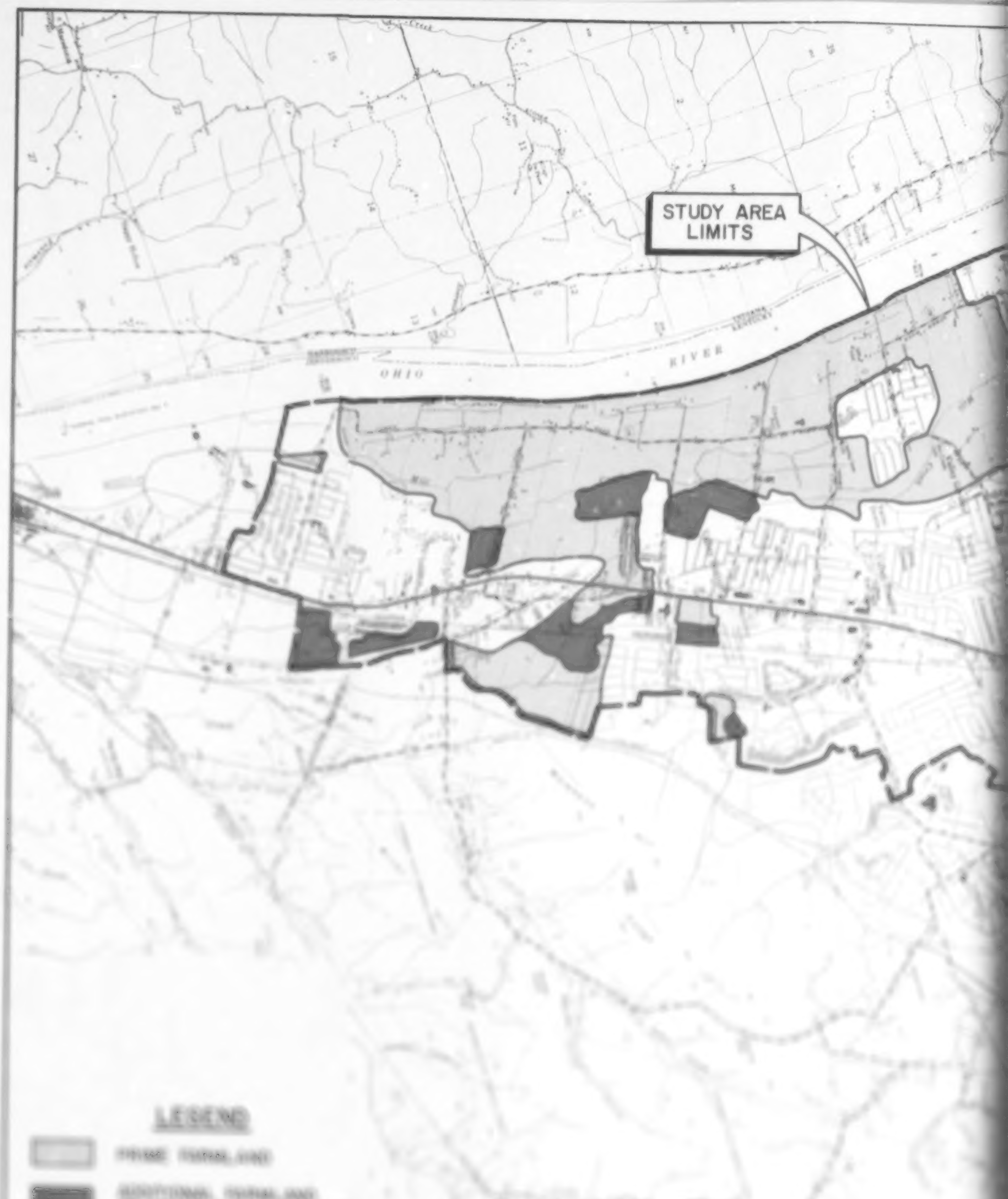


FIGURE 19

MILL CREEK
ENVIRONMENTAL IMPACT STATEMENT
JEFFERSON COUNTY, KENTUCKY

1975 AND 1995 LAND USE


STUDY AREA LIMITS
OHIO
RIVER
LEGEND
PRIME FARMLAND
ADDITIONAL FARMLAND OF STATEWIDE IMPORTANCE

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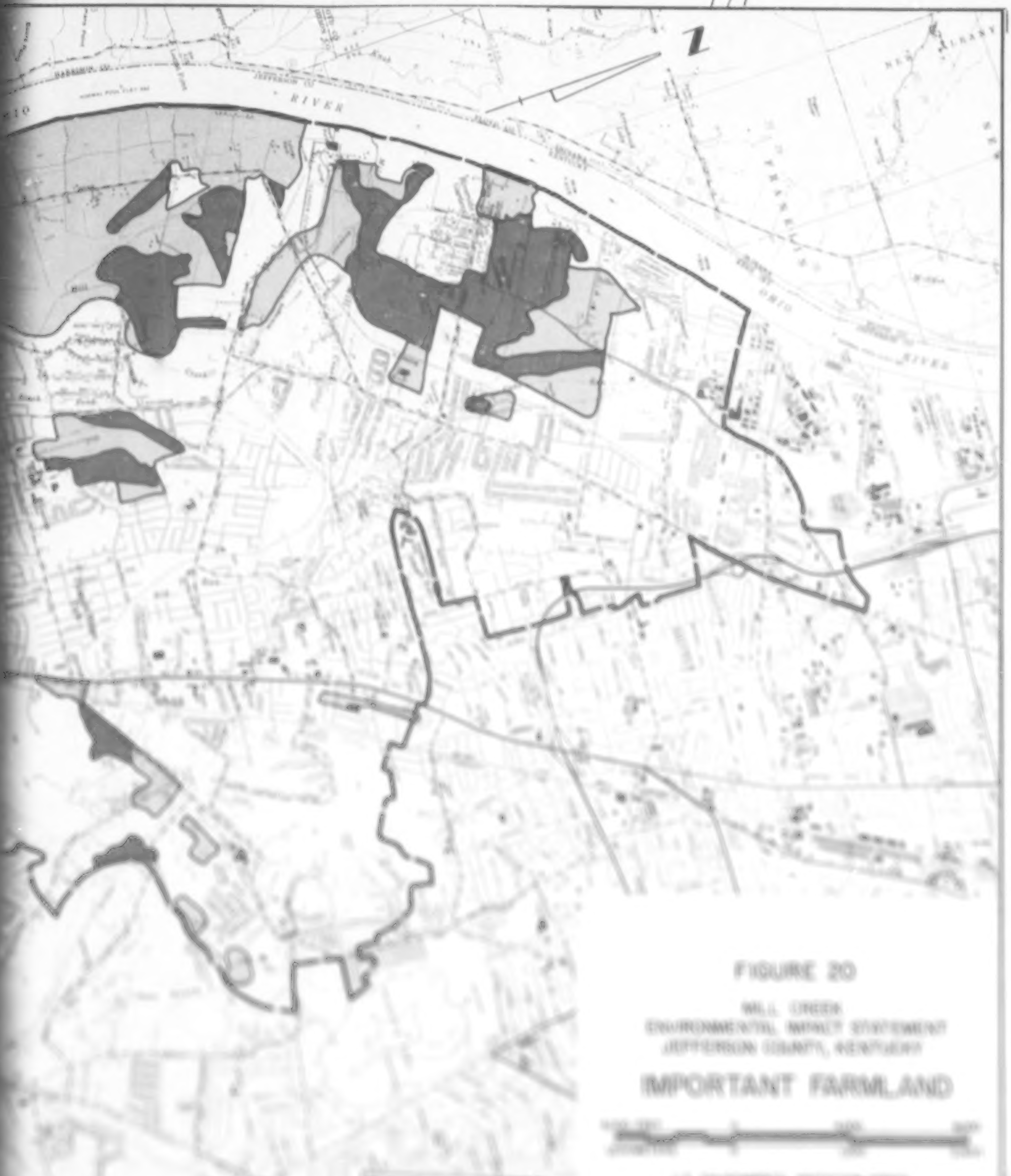

FIGURE 20

MILL CREEK
ENVIRONMENTAL IMPACT STATEMENT
JEFFERSON COUNTY, KENTUCKY

IMPORTANT FARMLAND

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV ATLANTA, GEORGIA

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Current average consumption of LWC water within the study area, determined by analysis of 1977 and 1978 billing records, is about 20,000 m^3/d (5.3 mgd), or about 230 L (60 gal) per capita per day. Average daily water demand in 1995, projected on the basis of curent water usage, will be about 31,000 m^3/d (8.2 mgd).

The LWC draws water from the Ohio River at a location several miles upstream from the Louisville business district. At present, no water utility utilizes the area groundwater resources for public water supply. However, certain households in the Mill Creek study area depend upon subsurface water for domestic uses, due to the absence of nearby water mains. It appears that between 300 and 600 residences in the study area may depend upon private wells for water supply. This total is unlikely to increase in the future, since recent LWC activity has been directed toward providing water service throughout the metropolitan area.

Existing Wastewater Management Systems

Residential and commercial development in the Mill Creek area has, until recent years, depended upon the use of individual on-site systems for wastewater disposal. The slowly permeable surface soils found in most of the study area were found to be unacceptable for subsurface wastewater disposal using conventional soil absorption fields. It was found that seepage pits (large-diameter, block-lined wells excavated through the upper soils to the glacial sands and gravels below) achieved adequate subsurface dispersion of wastewater. Development in the study area proceeded for some twenty years, with nearly all wastewater disposal being achieved by septic tanks and seepage pits.

Beginning in the late 1960's, the Louisville and Jefferson County Department of Public Health (L/JCDPH) exhibited progressively increasing concern for the potential public health and environmental problems arising from the continued proliferation of on-site disposal systems in the metropolitan area. The Board of Health passed a resolution in 1972 prohibiting the use of conventional on-site wastewater disposal systems for any residence built on a lot smaller than one acre (0.4 ha). This resolution brought development of on-site systems in the study area to a halt.

Residential subdivisions developed in the years subsequent to the Board of Health's decision have been served by collector sewers and small wastewater treatment plants. Several schools, commercial establishments, and institutional facilities in the Mill Creek area are also served by small treatment plants.

On-Site Systems

The number of existing dwellings and commercial establishments in each subarea was estimated by evaluation of LWC billing records. Aerial photographs were used to supplement the billing records and for subareas outside of the billing districts. The number of dwellings and businesses is given in Table [illegible]. All units are served by on-site disposal systems unless otherwise indicated.

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TABLE 43. SINGLE-FAMILY DWELLINGS, MULTIPLE-FAMILY DWELLINGS, AND COMMERCIAL UNITS IN MILL CREEK STUDY AREA

	1972				1995
Subarea	Single-Family Dwelling Units total (sewered)[a]	Mobile Homes total (sewered)	Multiple-Family Dwellings total (sewered)	Commercial Units total (sewered)	Additional Dwelling Units[b]
1	285	0	0	2	96
2	225	0	36	5	37
3	588	0	9	6	118
4	283	103	53	32	94
5	459	0	0	26	97
6	489	0	0	5	127
7	289	40	1	4	107
8	298	0	1	26	20
9	398	0	0	6	80
10	103	57	0	0	-
11	2	150	0	0	48
12	10	74	0	0	149
13	110	0	0	0	97
14	29	0	0	5	99
15	136	0	12	0	89
16	343	0	0	6	221
17	627	0	6	2	313
18	510	0	9	4	170
19	690	0	2	58	256
20	430	0	39	22	107
21	834	0	0	11	47
22	425	73 (73)	70 (70)	73	2,329
23	191	163	0	0	66
24	389	0	0	2	62
25	403	0	12	6	393
26	736	0	0	2	6
27	821	0	10	31	289
28	639	0	7	23	16
29	897	0	4 (2)	17	91
30	732	0	0	28	152
31	622	0	3	16	268
32	998	0	0	19	87
33	264	0	1	44	10
34	609	0	1	55	173
35	1,537	0	0	2	415
.36	23	87	0	28	71

(a) The nubmer in parentheses is the number of the total units that are sewered.

(b) The difference between 1995 and 1972 populations was divided by an average of 3.5 people per dwelling unit to determine the number of additional dwelling units.

TABLE 43. (CONT.)

	1972				1995
Subarea	Single-Family Dwelling Units total (sewered)[a]	Mobile Homes total (sewered)	Multiple-Family Dwellings total (sewered)	Commercial Units total (sewered)	Additional Dwelling Units[b]
37	153	0	0	1	99
38	42	253 (80)	0	6	234
39	188	0	0	14	126
40	109	53	0	21	311
41	52	0	0	4	87
42	122	0	0	9	0
43	192	180	0	15	63
44	63	0	0	3	64
45	0	0	0	0	122
46	11	0	0	1	44
47	10	0	0	0	334
48	33	0	0	3	563
49	728 (680)	0	68 (68)	19 (9)	988
50	6	0	0	1	214
51	49	0	0	0	357
52	281 (140)	0	0	33	829
53	300 (258)	0	0	11 (1)	673
54	58	0	0	3	502
55	696 (566)	0	0	25	797
56	65	18	0	1	552
57	49	22	0	10	215
58	1,037 (1,037)	0	0	4 (4)	25
Totals	20,668 (2,681)	1,273 (153)	344 (140)	750 (14)	13,999

In Jefferson County the authority to regulate construction and use of on-site wastewater disposal systems resides with L/JCDPH. Complaints regarding failures of on-site systems are received, recorded, and acted upon by the Health Department. The locations of failures inspected between April, 1976, and September, 1977, are shown in Figure 21. Users of on-site systems are noted as residential or commercial. It should be noted that the documented failures pertain to system malfunctions that can be detected at the ground surface.

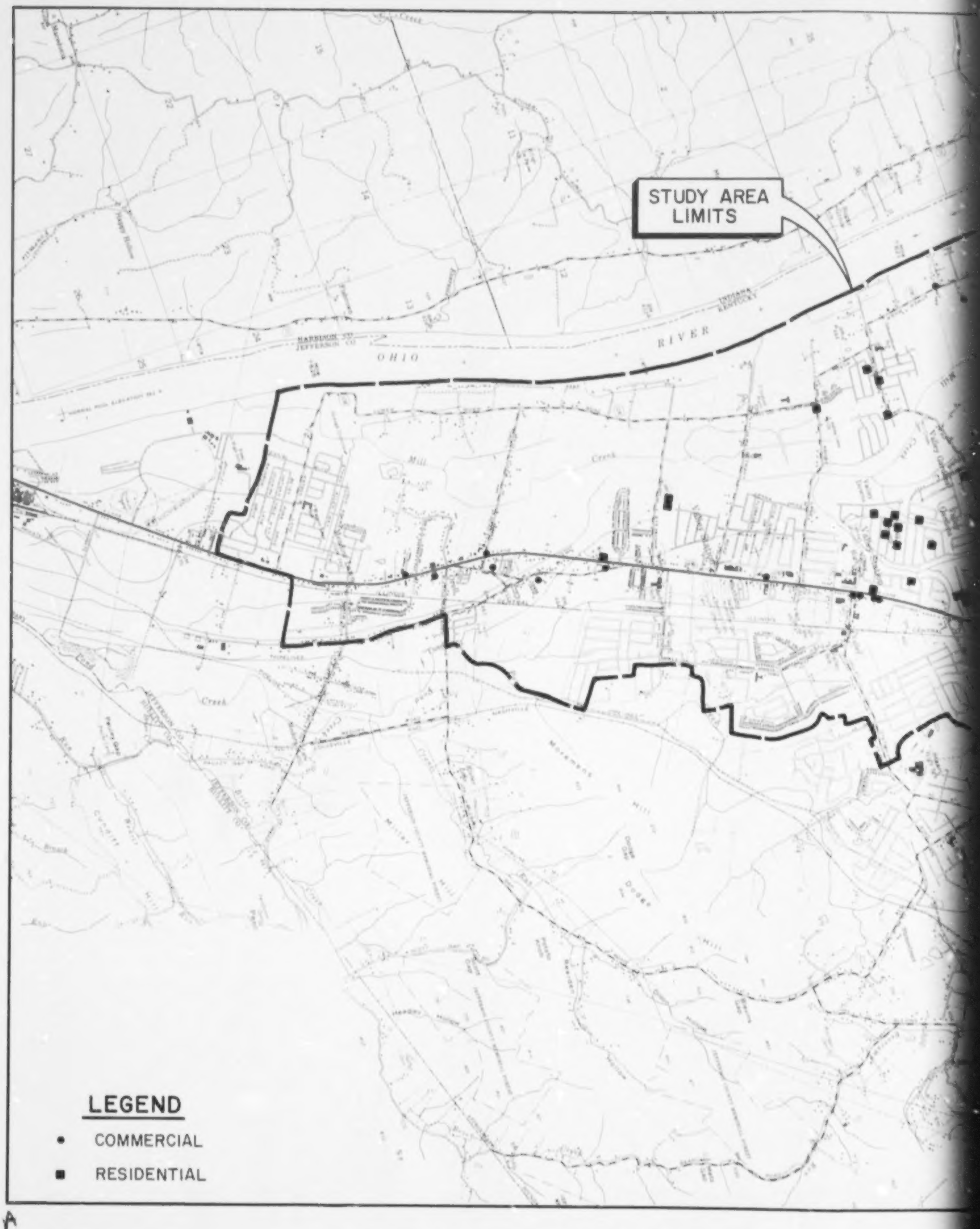
A typical on-site system consists of a septic tank for removal of floating and settleable solids and a subsurface disposal unit. System failure usually becomes evident when the inability of the disposal unit to disperse waste water causes the septic tank effluent to rise to the ground surface. Several conditions may lead to or aggravate disposal unit failure. Lack of maintenance, such as periodic solids removal, may allow sludge and grease to be flushed into discharge lines, clogging pipes or soil pore spaces. Also, soils of low permeability may not be capable of accepting wastewater flow, with especially severe problems occuring during wet seasons.

The problem of low soil permeability exists throughout much of the study area, as indicated previously. Although the upper soils in the study area are limited as to their acceptability for on-site disposal systems, the entire area is underlain by glacial sand and gravel. The highly permeable glacial material represents an attractive medium for accepting wastewater flows. Most on-site systems in the study area utilize the sandy deposits by directing septic tank effluent to seepage pits--wells 0.9-1.2 m (3-4 ft) in diameter excavated through the upper soil--to the more pervious materials below. By using seepage pits, most on-site system owners can avoid surface-evident failures. Failures such as those indicated in Figure 21 probably result from lack of septic tank maintenance, and consequent clogging of effluent piping or seepage pit soil surfaces.

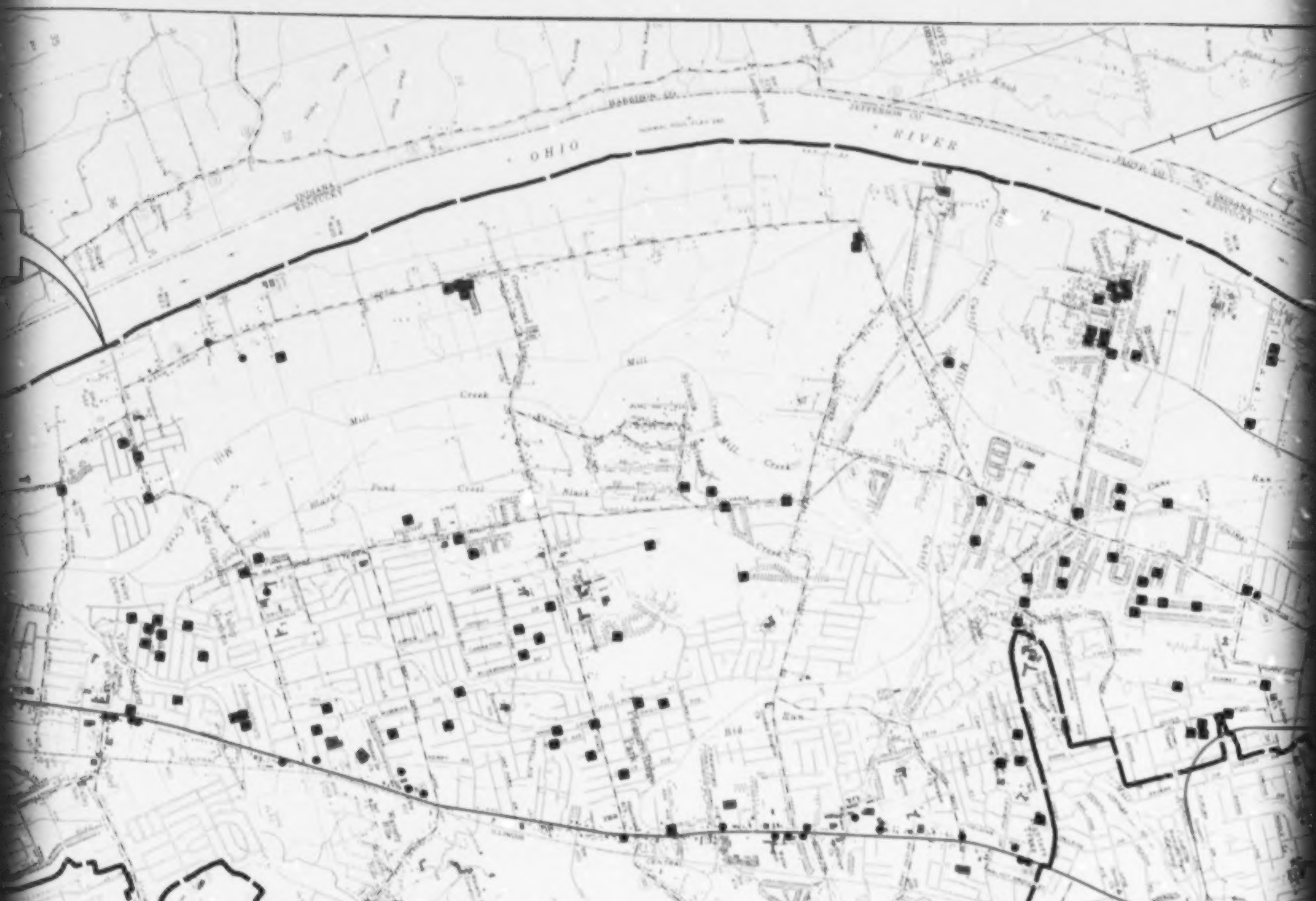
Small Wastewater Treatment Plants

A total of 26 small WWTPs, varying in capacity from 11 to 1,900 m^3/d (3,000 to 500,000 gpd), discharge treated wastewater to surface waterways in the Mill Creek system. A brief description of each small WWTP is provided in Table 44. Plant locations are shown in Figure 2.

Each small treatment plant is required to adhere to the requirements of a National Pollutant Discharge Elimination system (NPDES) permit issued by EPA. The effluent limitations for the WWTPs are shown in Table 7. Prior to July 1, 1979, the NPDES permits required "conventional secondary treatment" of wastewater prior to discharge. Adherence to this requirement could have been achieved by all WWTPs except the plants at the Wade Shacklette School (Number 14) and the Silver Palms Swim Club (Number 17). The post-July, 1979, discharge permit limitations will require "advanced secondary treatment" to achieve improved removal of suspended solids and oxygen-demanding pollutants. Reliable, long-term data regarding levels of treatment presently achieved by


STUDY AREA LIMITS
OHIO
RIVER
HARRISON CO.
JEFFERSON CO.
INDIANA
KENTUCKY
Mill
Creek
LEGEND
● COMMERCIAL
■ RESIDENTIAL

A



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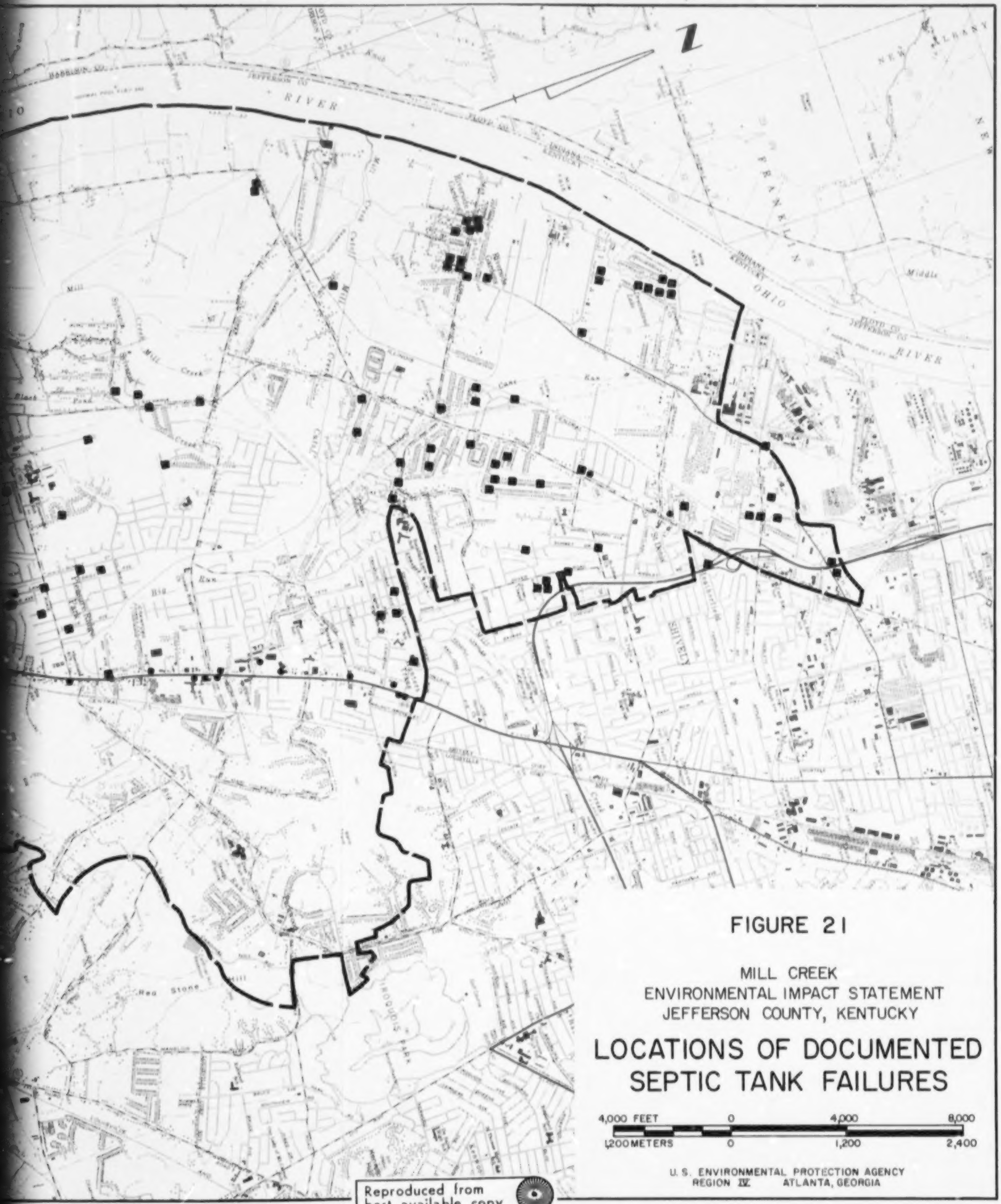

FIGURE 21

MILL CREEK
ENVIRONMENTAL IMPACT STATEMENT
JEFFERSON COUNTY, KENTUCKY

LOCATIONS OF DOCUMENTED SEPTIC TANK FAILURES

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV ATLANTA, GEORGIA

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TABLE 44. SMALL WASTEWATER TREATMENT PLANTS IN MILL CREEK STUDY AREA

	Name(a)	NPDES Permit No.	Design Flow		Actual Flow		Treatment Methods		Receiving Stream
			m^3/d	gpd	m^3/d	gpd	Liquid	Sludge	
1.	Valley Village Subdivision	00029637	1,900	500,000	1,900	500,000	Extended Aeration	Anaerobic Digestion (Heated)	Mill Creek
2.	Valley High School	00027073	270	71,000	110	29,000	Extended Aeration; Trickling Filter	Imhoff Tank	Mill Creek (600 Trib.)
3.	Villa Anna (MSD)	00022438	640	169,000	640	169,000	Extended Aeration	Anaerobic Digestion (Unheated)	Bee Lick Creek
4.	Beth Haven Baptist Church	00041874	130	35,000	28	7,500	Extended Aeration	Hauling	Bee Lick Creek (700 Trib.)
5.	Sanders Elementary School	00027138	28	7,500	18	4,700	Extended Aeration	Hauling	Davis Run Creek
6.	Westland Mall	00033430	110	30,000	110	30,000	Extended Aeration	Anaerobic Digestion (Unheated)	Mill Creek (800 Trib.)
7.	Timothy Hills Subdivision	00035190	380	100,000	380	100,000	Extended Aeration	Anaerobic Digestion (Unheated)	Mill Creek (700 Trib.)

Sources: NPDES Permit information; Louisville and Jefferson County Department of Public Health; Kentucky Department for Natural Resources and Environmental Protection

(a) Numbers keyed to plant locations in Figure 10.

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TABLE 44. (CONT.)

			Design Flow		Actual Flow		Treatment Methods		
	Name[a]	NPDES Permit No.	m^3/d	gpd	m^3/d	gpd	Liquid	Sludge	Receiving Stream
8.	Eden Apartments	00031771	150	40,000	150	40,000	Extended Aeration	Hauling	Mill Creek (800 Trib.)
9.	Eisenhower Elementary School	00026999	57	15,000	22	5,700	Extended Aeration	Hauling	Mill Creek (600 Trib.)
10.	Waverly Hills Apartments	00034916	230	60,000	(proposed)		Extended Aeration	Holding Tank	Mill Creek (Unnamed Trib.)
11.	Pleasure Ridge Park High School	00027120	250	65,000	130	33,000	Extended Aeration	Hauling	Mill Creek (Unnamed Trib.)
12.	Conway Middle School	00027197	57	15,000	28	7,500	Extended Aeration	Hauling	Mill Creek (Unnamed Trib.)
13.	S. W. Jefferson Co. Government Center	--	11	3,000	11	3,000	Extended Aeration; Sand Filter	Hauling	Mill Creek
14.	Shacklette, Wade School	00027014	30	8,000	20	5,200	Lagoon	Hauling	Ohio River
15.	R & W Laundromat	00035416	36	9,500	28	7,500	Extended Aeration	Hauling	Mill Creek
16.	Havalock Subdivision	00034924	340	90,000	340	90,000	Extended Aeration	Holding Tank	Big Run
17.	Silver Palms Swim Club	00041947	11	3,000	11	3,000	Septic Tanks; Sand Filter	Hauling	Big Run

TABLE 44. (CONT.)

	Name$^{(a)}$	NPDES Permit No.	Design Flow m^3/d	Design Flow gpd	Actual Flow m^3/d	Actual Flow gpd	Treatment Methods Liquid	Treatment Methods Sludge	Receiving Stream
18.	Cardinal Mobile Home Park	00035203	42	11,000	42	11,000	Extended Aeration	Hauling	Big Run
19.	Fordhaven Subdivision	00031747	570	150,000	140	38,000	Extended Aeration	Holding Tank	Big Run
20.	West Springfield Subdivision	---	760	200,000	470	120,000	Extended Aeration	Holding Tank	Big Run
21.	Forest Hills Subdivision	00039683	1,100	300,000	1,100	300,000	Extended Aeration	Holding Tank	Big Run
22.	Kerrick Elementary School	00027090	28	7,500	16	4,300	Extended Aeration	Hauling	Big Run (Unnamed Trib.)
23.	Wellington Sara Belle School	00027103	28	7,500	19	5,100	Extended Aeration	Hauling	Ohio River
24.	River Valley Mobile Home Park	00036366	110	30,000	110	30,000	Extended Aeration	Hauling	Pond Creek (Unnamed Trib.)
25.	Johnstown Elementary School	00026310	57	15,000	57	15,000	Extended Aeration	Hauling	Ohio River
26.	Woodhaven Medical Services	00043338	380	100,000	380	100,000	Extended Aeration	Holding Tank	Mill Creek

the existing small WWTPs do not exist. It can be stated, however, that none of the existing plants would be capable of meeting current permit limits.

Industrial Activity

Existing industrial activity occurs in the extreme northern portion of the study area. Information regarding industries within or near the study area is provided in Table 45. The sources for the information were the 1978 Kentucky Directory of Manufacturers (Kentucky Department of Commerce) and the KIPDA 208 Areawide Waste Treatment Management Plan, Section II (1978). Future industrial development may occur on land in the study area currently owned by the Louisville and Jefferson County Riverport Authority. Information concerning prospective industrial activities at Riverport is not available at this time.

In planning the sewerage system for the Mill Creek area, MSD estimated industrial activity in 1995 in terms of an industrial-equivalent population, i.e., the number of people that would generate domestic wastewater at a flow equivalent to that expected from the industries. This population was derived by applying a factor of 89 persons per hectare (36 persons per acre) to all the industrially zoned land in the area. The industrial-equivalent population for each subarea is shown in Table 40.

Solid Waste Disposal

Of six landfills in the Mill Creek study area, three are still active. The locations of the landfills are shown in Figure 22. the following site descriptions were obtained from L/JCDPH.

1. Lee's Lane Landfill: This landfill was closed by court order. The landfill has an unabated gas migration problem. Analysis of gas samples has revealed 47 different organic compounds. Landfill gas has migrated under a floodwall and forced the evacuation of several single-family residences. Domestic and industrial wastes constitute the fill material.

2. Campground Road Landfill: This landfill is currently active. Landfill gas was detected migrating from the site, so the owner installed a positive ventilating system for migration control. The system appears to be successful at this time. The fill is composed primarily of domestic waste material.

3. Southern Materials, Inc., Landfill: This active landfill is located near the intersection of Ralph Avenue and I-264. The fill is designed and permitted to receive construction debris and inert waste materials only, but it is known that some putrescible and industrial wastes have been received. Several surface fires have been reported, and the presence of an underground fire is under investigation.

TABLE 45. INDUSTRIAL ACTIVITY WITHIN OR NEAR THE MILL CREEK STUDY AREA

Industry Name	SIC Code	Products	Number of Employees
AIRCO, Inc.	28	Calcium carbide, acetylene, carbide lime	266
American Synthetic Rubber Corp.	28	Synthetic rubber latex	686
Borden Chemical Co.	28	Industrial resins, adhesives	26
E. I. Du Pont De Nemours & Co.	28	Synthetic elastomer, fluoridated hydrocarbons	1350
General Welding Co.	34	Pipe fabricating	130
B. F. Goodrich Chemical Co.	28	Synthetic rubber, PVC resins	1228
Kosmos Cement Co.	32	Cement	324
Reynolds Metals Co.	33	Metallic aluminum paint pigments	190
Rohm & Haas Kentucky, Inc.	28	Acrylic and plexiglas powder, plexiglas plastic sheet	544
Stauffer Chemical Co.	28	Chloroform, hydrogen chloride, perchloroethylene	145

Sources: Kentucky Department of Commerce (1978); KIPDA (1978).

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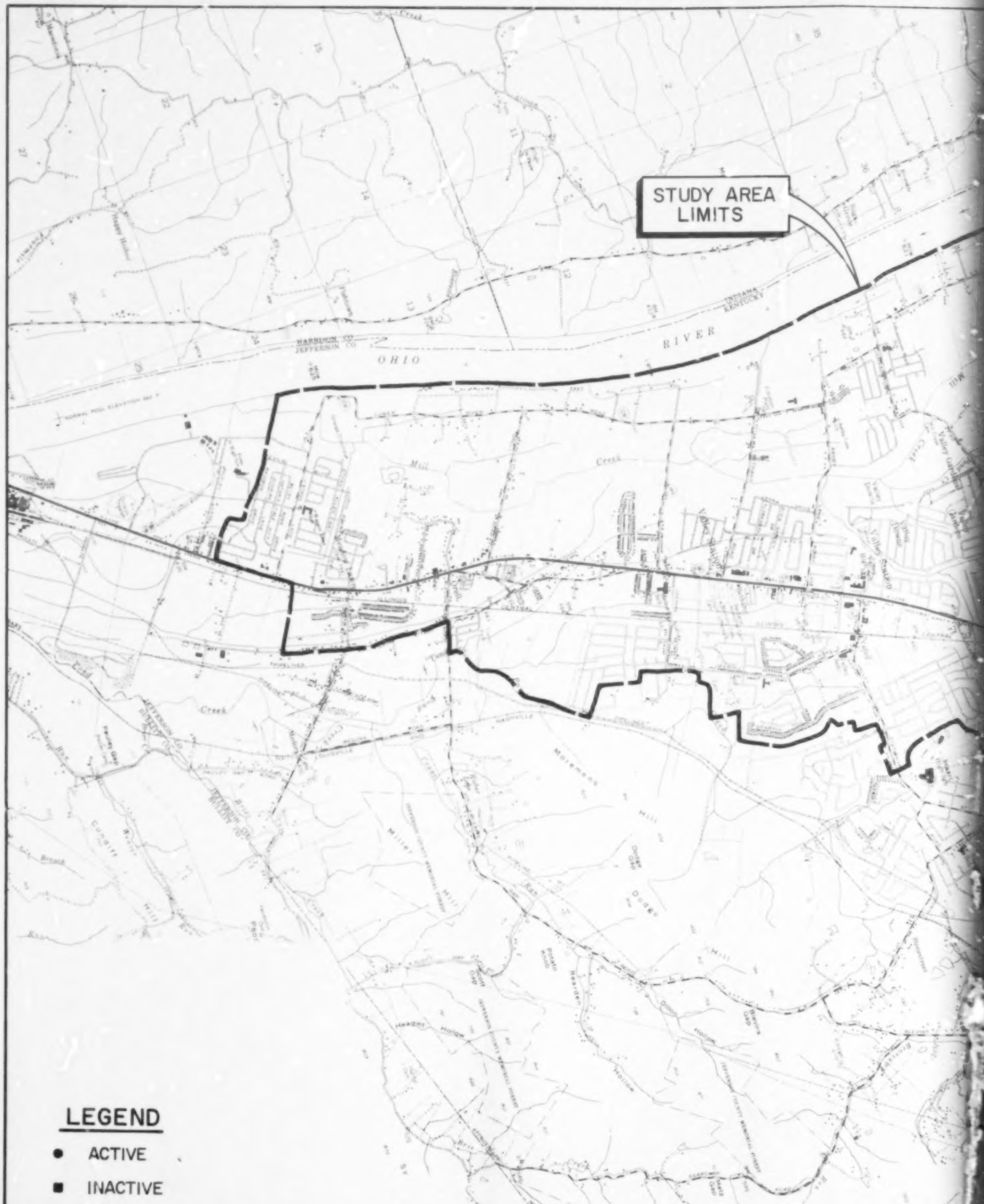
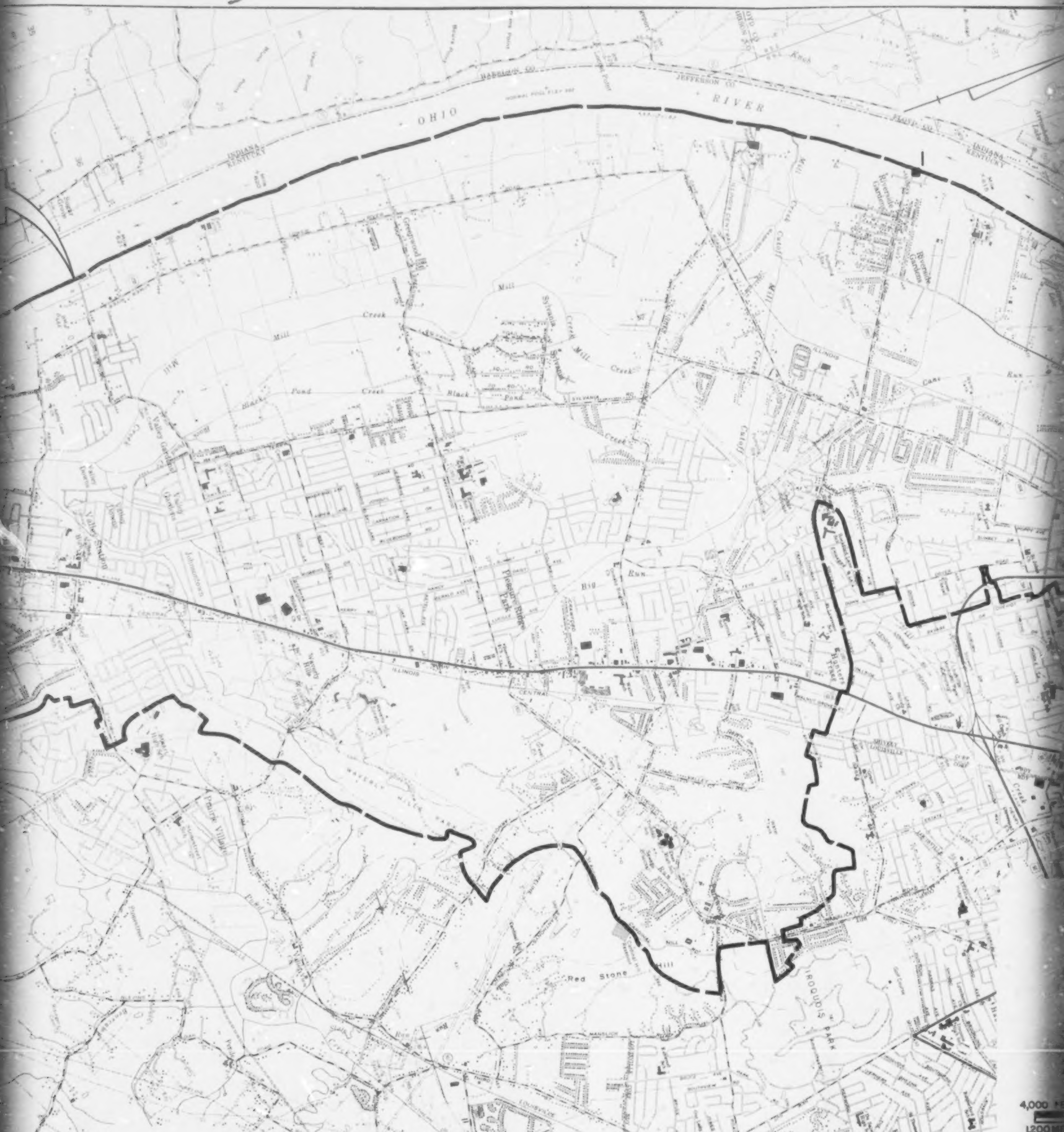


LEGEND

● ACTIVE

■ INACTIVE

B



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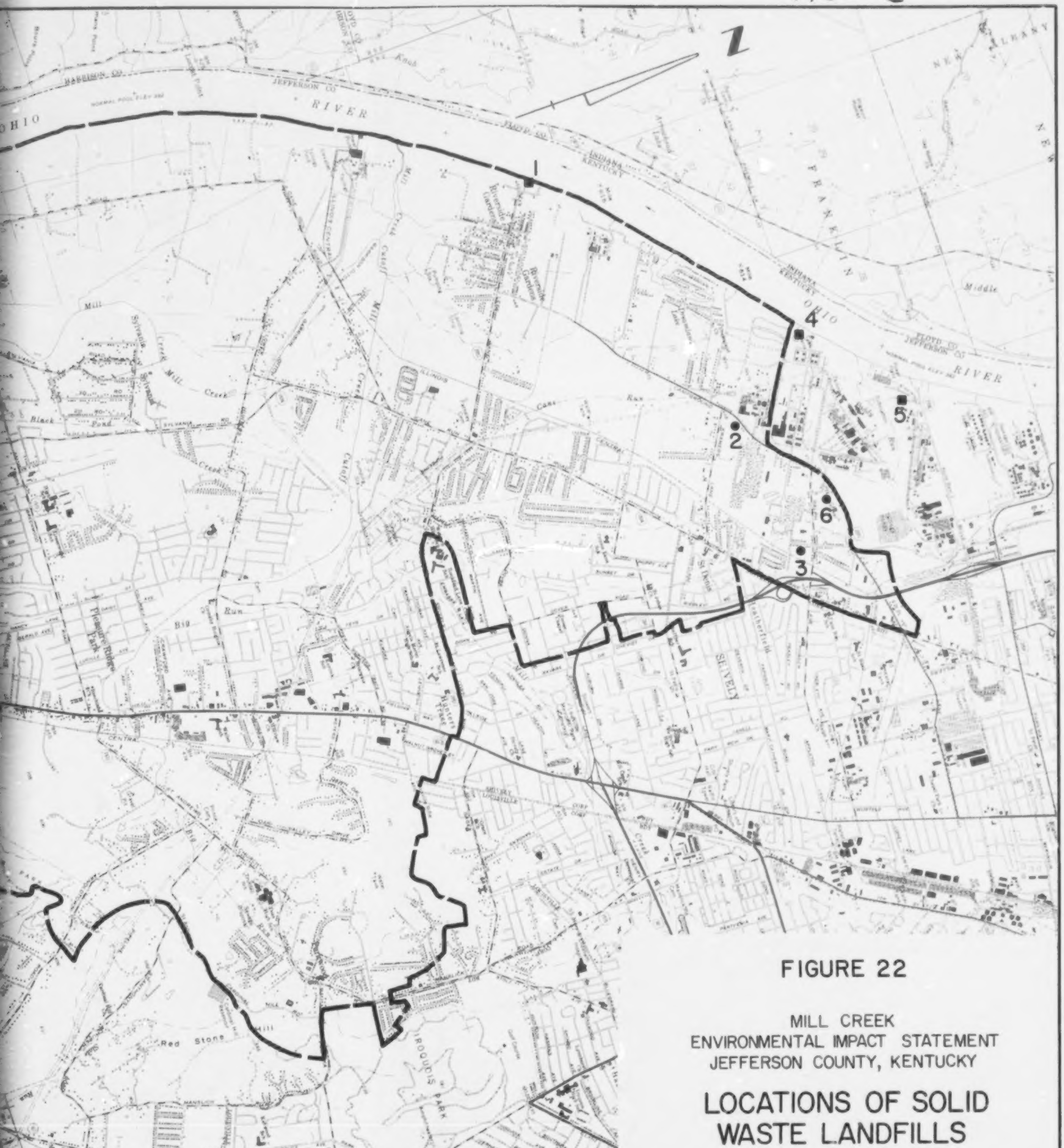

FIGURE 22

MILL CREEK
ENVIRONMENTAL IMPACT STATEMENT
JEFFERSON COUNTY, KENTUCKY

LOCATIONS OF SOLID WASTE LANDFILLS

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV ATLANTA, GEORGIA

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4. American Synthetic: This particular site was at one time a pit used for fly ash disposal. It is not currently being used.

5. Un-Named: An inactive landfill is located south of Bells Lane and west of I-264. While in operation it received both domestic and industrial wastes.

6. Scotts Landfill: This landfill located north of Ralph Avenue is currently operating as an inert waste fill. However, prior to the regulation of waste disposal, a portion of the present site may have received both domestic and industrial wastes.

Table 46, developed from information obtained from L/JCDPH, contains the size, materials and volumes accepted, and the expected life of the 3 active landfills in the study area.

Cultural History

The cultural history of this region is long and rich, if not yet fully explored. Occupations are documented for the last 10,000 years, and there is strong evidence of earlier occupations. An exceptionally long and abundant record of past human achievement is present, and a broad spectrum of cultural resources is available. The culture periods represented in the Jefferson County area summarized in Table 47.

A study of the distribution of archaeological sites in the Falls of the Ohio region and Jefferson County has been made recently by Driskell and Collins (Collins, in prep.). The region may be divided into three zones: the alluvial floodplains of the Ohio River, the interior lowlands, and the surrounding uplands. Generally, the sites are nearly evenly distributed between the floodplain and uplands, with a slight bias towards the floodplain.

With the exception of Paleo-Indian components, all culture periods are represented in western Jefferson County. In general, occupations tend to occur somewhat more commonly on the floodplain than in the uplands, and only rarely in the Scottsburg lowlands. The Late Archaic period is the best represented period; sites of that era are most commonly found on the floodplain. During later periods there is a decided shift away from the floodplain, resulting in Late Woodland and Village farmer sites occurring most commonly at higher elevations. Furthermore, within the floodplain of western Jefferson County there is a much higher occurrence (nearly 5 to 1) of sites on Wisconsin rather than Illinoian age alluvium.

Outdoor Recreation

Parks, playgrounds, and other outdoor facilities were considered in the recreation inventory of the Mill Creek study area. The primary source for this information was the Outdoor Recreation Plan (LJCPC 1973).

TABLE 46. ACTIVE LANDFILLS IN THE MILL CREEK STUDY AREA

Site	Size ha	Size ac	Materials Accepted	Volume Accepted m^3/d	Volume Accepted yd^3/d	Expected Life
Campground Road Landfill	8	50	domestic garbage	3,800	5,000	1987
Southern Materials	6	14	inert construction debris	490	640	1984
Scott's Landfill	small		inert construction debris	variable quantity		1981

TABLE 47. CULTURAL HISTORY OF JEFFERSON COUNTY

Culture Period	Distribution of Sites	Cultural Characteristics
Paleo-Indian (15,000-8,000 B.C.)	Floodplains and upland zones	Subsistence hunting, fishing, foraging Characteristic artifact: lanceolate projectile point
Archaic (8,000-1,000 B.C.)	Floodplains and upland zones	Band level societies, focused on hunting and gathering (No ceramics or full scale agriculture)
Early Archaic (8,000-5,000 B.C.)	Floodplains and upland zones	Small, intermittently occupied campsites
Middle Archaic (5,000-3,000 B.C.)	Few sites, scattered through the region	Few sites, no insoluble components reported
Late Archaic (3,000-1,000 B.C.)	Shift toward floodplains	Hunting and fishing; tools made of chipped stone, ground stone, bone or antler; dense burial areas
Woodland (1,000 B.C. - A.D. 900)	Floodplains	Crude ceramics; burial mounds; domesticated and cultivated plants
Village Farmer (A.D. 900-1650)	Upland zones	Prehistoric villages, towns, and possibly cities; corn as the pivotal crop; temple mounds; well-made shell-tempered pottery; bows and arrows
Historic (1650-present)	Floodplains and upland zones Limited by marshes and peat bogs in southern and western portions of the county	Contact with Europeans; Jefferson County founded 1780; growth of Louisville as a portage point around the Falls of the Ohio

Parks within the Louisville/Jefferson County planning area are placed in four different categories: major urban parks, community parks, neighborhood parks, and special facilities. Table 48 is a descriptive summary of these park categories, all of which are represented within the study area. Table 49 lists the major urban parks, community parks, and special facilities found within the study area, and Figure 15 shows the locations of these parks. Neighborhood parks, because of their small size and large numbers, are not included here, but can be obtained from the Outdoor-Recreation Plan (LJCPC 1973). Many of the community and neighborhood parks consist of school playgrounds, sports fields, and courts.

Park needs--determined on the basis of available size per population unit, accessibility, and population projections (LJCPC 1973)--are met fairly well in the Mill Creek area. Community parks are currently well situated in the study area, and major urban parks are more than adequate except for the southwestern portion, where accessibility is poor. An insufficient number of neighborhood parks exists in the central and northern portions of the study area to the west of Dixie Highway and in the area north of Iroquois Park. Special facilities are well situated except for a shortage of swimming pools in the northern portion of the study area.

5.3.2 Effects of the Alternatives on the Man-Made Environment.

The following discussion of effects of the alternatives on the man-made environment involves a slight departure from the Description of the Man-Made Environment (Section 5.3.1) in impact categories. This section deals more accurately with the socio-economic consequences of the alternatives, focusing on those impact areas that are most relevant to this study.

It was noted in previous sections of this report that for each system alternative there are three distinct groups that might be affected. They include populations presently served by small treatment plants, populations presently served by septic tanks, and future populations. Impacts to future populations are discussed for those impact assessment categories where it was determined that there was a reasonable chance an impact would occur.

The impact categories relevant to this study include

1. Impacts to cultural resources;
2. Impacts to social interaction;
3. Impacts to public health and welfare;
4. Employment opportunity;
5. Population growth as it relates to rate and density;
6. Housing quality and value;
7. Public acceptance; and
8. Land use development and distribution.

The following discussion defines the impact categories listed above so that the reviewer can evaluate the analysis process. A category is not discussed if it is not relevant to an alternative, but each category is presented on the summary matrix for each system alternative.

TABLE 48. PARK CATEGORIES

1. Neighborhood Parks

Land Area Needs: 1.0 ha/1000 people (2.5 acres/1000 people)
Service Population: 1400-13,000
Service Area: 0.8 km (0.5 mi) maximum
Size: 3 ha (7 ac) minimum
Activities Description: multi-use, unsupervised playgrounds, field and court sports areas.

2. Community Parks

Land Area Needs: 1.0 ha/1000 people (2.5 acres/1000 people)
Service Population: 5,000-50,000
Service Area: 3 km (2 mi) maximum
Size: 5.1 ha (12.5 ac) minimum
Activities Description: facilities oriented toward older children, organized sports, family activities, picnicking; also serves as a neighborhood park for nearby residents.

3. Major Urban Parks

Land Area Needs: 2 ha/1000 people (5 acres/1000 people)
Service Area: 40 minutes maximum driving time
Size: 40 ha (100 ac) minimum
Activities Description: occasional outings and special purposes, such as hiking, camping, swimming, skating, horseback riding, picnics, etc.; also serves as a community and neighborhood facility for nearby residents. Natural settings are emphasized.

4. Special Facilities

- Golf Courses
  - Service population: 27,000-50,000
  - Service area: 3/4-1 hr. maximum driving time
  - Size: 24-65 ha (60-160 ac)
- Swimming Pools
  - Service population: 25,000
- Day Camps
  - Service population: 25,000
- Amphitheaters, Botanical Gardens, Zoos
  - Area needs: one per urban area
- Overnight and Family Camps

TABLE 49. PARKS WITHIN THE MILL CREEK STUDY AREA

Major Urban Parks

A.	Iroquois Park (299 ha; 739 ac)	(G) (A)
B.	Waverly Park (122 ha; 302 ac)	(C) (G)
C.	Sun Valley Park (48 ha; 118 ac)	(C) (G)

Community Parks

1. Western High School and Rockford Lane Elementary School
2. Bishop David High School and Kerrick Elementary School
3. Riverview Park
4. Shacklette Elementary School
5. Pleasure Ridge Park High School and Greenwood Elementary School
6. Waller Elementary School
7. Doss High School
8. Valley High School (S) and Dixie Elementary School
9. Jesse Stuart High School and Lazne Elementary School
10. Medora II Playground
11. Watson Lane Elementary School
12. Frost High School

Note: Does not include neighborhood parks. Locations are shown in Figure 12 keyed to the letters and numbers given here. Special facilities: (S) Swimming (C) Campsites
(G) Golf course (A) Amphitheatre

Impacts to Cultural Resources

Cultural resources are artifacts and physical features that represent the social, economic, or cultural activities and events associated with groups or individuals. Cultural resources may be archaeological sites, historic homes, early or unique bridges or industrial sites, or any other manifestations of previous important human activities that could provide an understanding of pre-historic and historic activities or events. Cultural resources are usually viewed as being non-renewable and any loss of a significant cultural resource is usually considered an irreversible impact.

Impacts to Social Interaction

Social groups and individuals interact in a number of various ways, either directly or indirectly. This interaction covers a range of human activities from direct person-to-person communication by individuals in the same room to long-distance communication and interactions of whole societies via treaties or trade agreements. In this evaluation we are primarily concerned with the interactions of individuals, families, and neighborhoods. Each alternative was evaluated to determine if it would affect person-to-person communications, disrupt family routines, or prohibit or restrict normal neighborhood activities such as travel, shopping, education, and entertainment.

Impacts to Public Health and Welfare

General or specific threats to the mental or physical health of individuals or the community's ability to maintain a safe, sanitary, and wholesome environment are evaluated under this category. Impacts to public health and welfare could include changes in water quality, increases in pollution, creation of high risk situations or the aggravation of an existing dangerous situation. For the purposes of this EIS, impacts to public health relate primarily to the use of groundwater or surface water. Groundwater is not heavily used for water supply in this area, although approximately 300 to 600 homes have private wells. No near-term plans exist for use of the area's groundwater for public water supply. The primary function of the local streams is drainage. Secondarily, they are used for unsupervised recreation, including some body-contact recreation. These uses of the streams must be considered, therefore, when discussing health impacts.

Employment

Employment opportunities may be increased or decreased, both directly and indirectly, by federal policy and programs and the effects of these actions on the individual and the community must be considered. Threats to employment opportunities normally include such areas as isolation of workers from employment centers, mechanization and automation, out-migration or failure of businesses, or any other actions or regulations that would damage the exporting ability of local primary industries.

Population Growth

There are two primary qualities of population: rate of growth and spatial distribution. Certain actions are capable of stimulating or reducing population growth and directing this growth or no-growth into areas where it is desired or not desired. Rapid increases or decreases in population are usually viewed in negative terms due to the boom-town/ghost-town situation they create. Even slower rates of change may be viewed in negative terms if institutions, services, and business activities cannot keep pace with this change.

Housing

A house is the major lifetime investment of most middle-income groups and in many cases an unmortgaged house provides the only hedge against inflation for retired or fixed-income groups. As a result, any actions that reduce the quality or value of housing should be considered a serious impact. The value and quality of housing can be affected by what is constructed near it or by changes in the environment that result in unwanted modifications to the dwelling. This category evaluates each alternative to determine what indirect impacts or modifications to housing they could initiate.

Public Acceptance

In all societies certain accepted norms are established and maintained by individuals or institutions that are collectively known as "Gatekeepers." It is the objective of most public participation programs to identify these gatekeepers and to determine what is and is not acceptable to the community. Change forced upon the community from both inside and outside the community can sometimes have unexpected and significant consequences. This category attempts to establish what change is socially acceptable and what is unacceptable to the community and to determine if any of the proposed alternatives will create acceptable or unacceptable change from the viewpoint of the majority of the population.

Land Use

Past and present social and economic needs combine with environmental factors to create a natural evolutionary process in the character and location of human activities. This evolutionary process is represented by the ever changing fabric of land use patterns. Sudden and/or drastic changes in the anticipated trend in land use evolution is generally viewed with alarm by area residents and can cause secondary impacts in the areas of transportation, education, and community services. This category attempts to establish what the accepted and reasonable changes in land use will be and whether or not a proposed alternative will conflict with this anticipated trend.

Evaluation of System Alternatives

The evaluation process requires that several judgments concerning impacts and the level of significance of each impact be made. The easiest judgment made concerned the identification of impacts which will occur at the time of the action. Other impacts that are more difficult to predict are the indirect consequences of an alternative that may occur some time in the future or over an elapsed period of time. The basis of evaluation for the identification of impacts, and justification of the level of significance assigned each impact, are briefly described in the narrative accompanying each alternative evaluation matrix. The matrix represents the evaluation tool used to systematically identify and present impacts for each alternative.

System Alternative 2_a (Table 50)

The evaluation of this and all other options that use small wastewater treatment plants is complicated by the fact that three alternative methods of treated wastewater disposal are available: continued discharge to surface streams, subsurface discharge via a large seepage pit, and land application. Each one of these subalternatives would, in turn, have different socioeconomic impacts. The EIS groundwater program has concluded that septic tanks are influencing groundwater quality in the area. The addition of new subsurface wastewater discharges from this portion of the community must be recognized as contributing to the continued influence of wastewater on groundwater quality.

The public health impacts of wastewater influences are somewhat tempered by the existing and intended uses of the area groundwater as a drinking water source. The majority of the residents in the area are served by the Louisville Water Company, which has indicated that there are no near-term plans to use the southwestern portion of the aquifer to replace or supplement water supplies. The EIS groundwater program has indicated that the groundwater is not suitable as an untreated drinking water source.

Future population can be accommodated by either small wastewater treatment plants, on-site systems (if the existing Board of Health regulation is modified), or existing sewer lines. Given these opportunities, impacts to population growth are not expected.

Land application and the subsurface discharge of wastewater would have the greatest impacts to cultural resources since they require the greatest amount of landform modification. Subsurface discharge would have the greatest immediate impact since it could result in any buried cultural features being dug up and destroyed. Land treatment impacts would occur over a long term period and would result in changes in soil conditions, washing and erosion of features and artifacts, and the migration of site stratigraphy.

Land application could also adversely affect social interaction by consuming large tracts of valuable urban or suburban land needed by community recreation, education, services, etc. All three of the subalternatives could affect public health. Land application could increase odors in the study area while subsurface discharge will likely contribute to the groundwater being influenced by wastewater. The discharge of treated wastewater to surface streams is already impacting water quality of those streams and represents a potential health problem. Although these discharges would be upgraded, the potential for health-related impacts would remain.

In the areas of population growth, housing quality, public acceptance, and land use, the land treatment subalternative would have minor to significant impacts, primarily due to the land area requirements of this alternative and the difficulties resulting from fitting this alternative into the existing urban fabric.

TABLE 50. SOCIO-ECONOMIC ANALYSIS OF ALTERNATIVE SYSTEM 2a

Category of Impact	Population Presently Served By Small Treatment Plants				Population Presently Served By Septic Tanks				Future Population			
	none	minor	moderate	significant	none	minor	moderate	significant	none	minor	moderate	significant
Cultural Resources	○-S		●-L	●-SS	○						●	
Social Interaction	○-SS ○-S		●-L		○				○			
Public Health and Welfare		●-SS	●-S ●-L			●				●		
Employment	○-S ○-SS ○-L				○				○			
Population Growth	○-SS ○-S	●-L			○				○			
Housing Quality	○-SS ○-S	●-L			○				○			
Public Acceptance	○-SS ○-S		●-L		○				○			
Land Use	○-SS ○-S			●-L	○					●		

KEY: ○-No Impact, ●-Adverse Impact, ☆-Beneficial Impact, S-Small WWTP with surface water discharge, SS-Small WWTP with subsurface discharge, L-Small WWTP with land discharge.

System Alternative 2b (Table 51)

The continued use of wastewater treatment plants in areas presently served by these plants will have the same impacts under this alternative as those identified for this same subalternative in alternative 2a. Additional impacts must be discussed, however, for those areas presently served by septic tanks and areas where future population growth will be served by a treatment plant (see Figure 2). The portions of these two areas where septic tanks will be used will have the same impacts as those listed and discussed in alternative 2a for areas presently served by septic tanks and future populations served by septic tanks. New impacts will result, however, in these areas as a result of sewering and the surface, subsurface, and land application subalternatives.

Minor to significant impacts will result from these three subalternatives due to the land modification requirements of each. The degree of each impact is dependent upon the amount of land needed and the degree of change involved.

Impacts in the area of social interactions will occur to populations presently served by septic tanks due to the inconveniences caused by switching from an existing system to a new system. Land application will have the greatest impact due to the land requirements of this alternative. All of the subalternatives will affect public health because of noise, odors, and potential pollution of the groundwater and surface streams. In addition land application could have an impact upon population growth, housing quality, public acceptance, and land use for the same reasons as those presented for the land application subalternative in alternative 2a.

Surface and subsurface discharge subalternatives would most likely be resisted by people currently on septic tanks due, primarily, to the costs involved with switching systems.

System Alternative 6 (Table 52)

The connection of every household in the study area to a regional wastewater treatment system (Figure 1) would have both negative and beneficial impacts. The most significant negative impacts resulting from this alternative would occur to populations presently served by septic tanks and would primarily be related to social interaction and public acceptance. Disruption of the daily routine and other social functions would be likely to occur during the extensive and widespread construction phase of this alternative. Legal action and opinions expressed by a significant portion of the population at public meetings indicated that public acceptance of this alternative by people with septic tanks is low. Most of these objections are due to the costs to the homeowner associated with this alternative.

The greatest benefits from this alternative and the smallest number of negative impacts will occur to future populations. These benefits will be in the areas of public health and housing quality since this alternative will remove pollution from area streams and because sewers are usually a desirable element to new home buyers. The improvements in water quality to the aquifer resulting from the removal of septic tank discharges is somewhat offset by the impacts this alternative will have on the Ohio River outside the study area.

TABLE 51. SOCIO-ECONOMIC ANALYSIS OF ALTERNATIVE SYSTEM 2b

Category of Impact	Population Presently Served By Small Treatment Plants				Population Presently Served By Septic Tanks				Future Population			
	none	minor	moderate	significant	none	minor	moderate	significant	none	minor	moderate	significant
Cultural Resources	○-S		●-L	●-SS	○-ST	●-S		●-L ●-SS		●-S	●-ST	●-L ●-SS
Social Interaction	○-SS ○-S		●-L		○-ST	●-SS ●-S		●-L	○-ST ○-SS ○-S ○-L			
Public Health and Welfare		●-SS	●-S ●-L			●-ST ●-SS	●-S ●-L			●-ST ●-SS	●-S ●-L	
Employment	○-S ○-SS ○-L				○-ST ○-S ○-SS ○-L				○-ST ○-S ○-SS ○-L			
Population Growth	○-SS ○-S	●-L			○-ST ○-SS ○-S	●-L			○-SS ○-S	●-ST ●-L		
Housing Quality	○-SS ○-S	●-L			○-ST ○-SS ○-S	●-L			○-ST ○-SS ○-S	●-L		
Public Acceptance	○-SS ○-S		●-L		○-ST			●-S ●-SS ●-L	○-ST ○-S ○-SS	●-L		
Land Use	○-S ○-SS			●-L	○-ST ○-S ○-SS			●-L	○-S ○-SS	●-ST		●-L

KEY: ○-No Impact, ●-Adverse Impact, ☆-Beneficial Impact, ST-Septic Tanks, S-Small WWTP with surface water discharge, SS-Small WWTP with subsurface discharge, L-Small WWTP with land discharge.

TABLE 52. SOCIO-ECONOMIC ANALYSIS OF ALTERNATIVE SYSTEM 6

Category of Impact	Population Presently Served By Small Treatment Plants				Population Presently Served By Septic Tanks				Future Population			
	none	minor	moderate	significant	none	minor	moderate	significant	none	minor	moderate	significant
Cultural Resources		●					●			●		
Social Interaction		●						●	○			
Public Health and Welfare		●-OS		☆		●-OS	☆		○	●-OS		
Employment	○				○				○			
Population Growth	○				○				○			
Housing Quality	○				○					☆		
Public Acceptance	○						●		○			
Land Use	○				○				○			

KEY: ○-No Impact, ●-Adverse Impact, ☆-Beneficial Impact, OS-Impact occurs outside of study area.

This factor is reflected on the matrix by the code which illustrates those impacts occurring outside the study area. If an impact is not designated as an impact occurring outside the study area, the impact is assumed to occur within the Mill Creek Basin. The magnitude of the public health impacts were based on the the assumption that the Ohio River's capacity to assimilate wastewater is greater than that of area streams.

An impact to cultural resources could occur from this alternative due to the construction of sewer lines.

System Alternative 7a (Table 53)

Impacts to populations presently served by small treatment plants and impacts to future populations under this alternative will be the same as a combination of the impacts described for these groups under alternatives 2a and 6. Impacts to populations presently served by septic tanks will be the same as the impacts presented for this population under alternative 2a.

System Alternative 7b (Table 54)

Impacts to population presently served by small treatment plants will be the same as a combination of the impacts to this group described in alternatives 2a and 6. The impacts to population presently served by septic tanks and future populations will be the same for this alternative as those impacts described for these two groups in alternative 2a.

System Alternative 7c (Table 55)

Impacts to most of the population presently served by small treatment plants and impacts to future populations under this alternative would be similar to the impacts for alternatives 2a and 6. Impacts to populations presently served by septic tanks would be similar to those presented for 2a. Note that alternative 7c represents the first phase of what could ultimately be the regional system. The socio-economic analysis of alternative 6 would then be applicable.

System Alternative 8 (Table 56)

Impacts to most of the population presently served by small treatment plants and impacts to future populations under this alternative would be similar to the impacts for alternatives 2a and 6. Impacts to populations presently served by septic tanks would be similar to those presented for 2a. Note that alternative 8 represents the first phase or the 201 plan regional system. The socio-economic analysis for phase 1 is therefore similar to alternative 7c and would ultimately be similar to alternative 6.

System Alternative 9 (Table 57)

The impacts from the no-action alternative have been presented in earlier evaluations for each population. The impacts to populations presently served by small treatment plants and septic tanks will be the same as those impacts presented for this group in alternative 2a. Impacts to future populations will be the same as those impacts listed for this group in alternative 2b except that the septic tank subalternative is not considered here.

TABLE 53. SOCIO-ECONOMIC ANALYSIS OF ALTERNATIVE SYSTEM 7a

Category of Impact	Population Presently Served By Small Treatment Plants				Population Presently Served By Septic Tanks				Future Population			
	none	minor	moderate	significant	none	minor	moderate	significant	none	minor	moderate	significant
Cultural Resources	○-S	●-RP	●-L	●-SS	○					●-S ●-RP	●-ST	●-L ●-SS
Social Interaction	○-SS ○-S	●-RP	●-L		○				○-RP ○-ST ○-S ○-SS ○-L			
Public Health and Welfare		●-SS ●-RP OS	●-S ●-L	☆-RP		●			○-RP	●-ST ●-SS ●-RP OS	●-S ●-L	
Employment	○-SS ○-S ○-L ○-RP				○				○-ST ○-S ○-SS ○-RP ○-L			
Population Growth	○-SS ○-S ○-RP	●-L			○				○-SS ○-S ○-RP	●-ST ●-L		
Housing Quality	○-SS ○-S ○-RP	●-L			○				○-ST ○-SS ○-S	●-L ☆-RP		
Public Acceptance	○-SS ○-S ○-RP		●-L		○				○-ST ○-S ○-SS ○-RP	●-L		
Land Use	○-SS ○-S ○-RP			●-L	○				○-ST ○-S ○-SS ○-RP			●-L

KEY: ○-No Impact, ●-Adverse Impact, ☆-Beneficial Impact, ST-Septic Tanks, S-Small WWTP with surface water discharge, SS-Small WWTP with subsurface discharge, L-Small WWTP with land discharge, RP-Regional WWTP, OS-Impact occurs outside of study area.

TABLE 54. SOCIO-ECONOMIC ANALYSIS OF ALTERNATIVE SYSTEM 7b

Category of Impact	Population Presently Served By Small Treatment Plants				Population Presently Served By Septic Tanks				Future Population			
	none	minor	moderate	significant	none	minor	moderate	significant	none	minor	moderate	significant
Cultural Resources	○-S	●-RP	●-L	●-SS	○						●	
Social Interaction	○-SS ○-S	●-RP	●-L		○				○			
Public Health and Welfare		●-SS ●-RP OS	●-S ●-L	☆-RP		●				●		
Employment	○-SS ○-S ○-L ○-RP				○				○			
Population Growth	○-SS ○-S ○-RP	●-L			○				○			
Housing Quality	○-SS ○-S ○-RP	●-L			○				○			
Public Acceptance	○-SS ○-S ○-RP		●-L		○				○			
Land Use	○-S ○-SS ○-RP			●-L	○				○			

KEY: ○-No Impact, ●-Adverse Impact, ☆-Beneficial Impact, S-Small WWTP with surface water discharge, SS-Small WWTP with subsurface discharge, L-Small WWTP with land discharge, RP-Regional WWTP, OS-Impact occurs outside of study area.

TABLE 55. SOCIO-ECONOMIC ANALYSIS OF ALTERNATIVE SYSTEM 7c

	Population Presently Served By Small Treatment Plants				Population Presently Served By Septic Tanks				Future Population			
Category of Impact	none	minor	moderate	significant	none	minor	moderate	significant	none	minor	moderate	significant
Cultural Resources	○-S	●-RP	●-L	●-SS	○					●		
Social Interaction	○-SS ○-S	●-RP	●-L		○				○			
Public Health and Welfare		●-SS ●-RP OS	●-S ●-L	☆-RP		●				●-OS		
Employment	○-SS ○-S ○-L ○-RP				○				○			
Population Growth	○-SS ○-S ○-RP	●-L			○				○			
Housing Quality	○-SS ○-S ○-RP	●-L			○					☆		
Public Acceptance	○-SS ○-S ○-RP		●-L		○				○			
Land Use	○-SS ○-S ○-RP			●-L	○				○			

KEY: ○-No Impact, ●-Adverse Impact, ☆-Beneficial Impact, S-Small WWTP with surface water discharge, SS-Small WWTP with subsurface discharge, L-Small WWTP with land discharge, RP-Regional WWTP, OS-Impact occurs outside of study area.

TABLE 56. SOCIO-ECONOMIC ANALYSIS OF ALTERNATIVE SYSTEM 8

Category of Impact	Population Presently Served By Small Treatment Plants				Population Presently Served By Septic Tanks				Future Population			
	none	minor	moderate	significant	none	minor	moderate	significant	none	minor	moderate	significant
Cultural Resources	○-S	●-RP	●-L	●-SS	○					●		
Social Interaction	○-SS ○-S	●-RP	●-L		○				○			
Public Health and Welfare		●-SS ●-RP OS	●-S ●-L	☆-RP		●				●-OS		
Employment	○-SS ○-S ○-L ○-RP				○				○			
Population Growth	○-SS ○-S ○-RP	●-L			○				○			
Housing Quality	○-SS ○-S ○-RP	●-L			○					☆		
Public Acceptance	○-SS ○-S ○-RP		●-L		○				○			
Land Use	○-SS ○-S ○-RP			●-L	○				○			

KEY: ○-No Impact, ●-Adverse Impact, ☆-Beneficial Impact, S-Small WWTP with surface water discharge, SS-Small WWTP with subsurface discharge, L-Small WWTP with land discharge, RP-Regional WWTP, OS-Impact occurs outside of study area.

TABLE 57. SOCIO-ECONOMIC ANALYSIS OF ALTERNATIVE SYSTEM 9

Category of Impact	Population Presently Served By Small Treatment Plants				Population Presently Served By Septic Tanks				Future Population			
	none	minor	moderate	significant	none	minor	moderate	significant	none	minor	moderate	significant
Cultural Resources	○-S		●-L	●-SS	○					●-S		●-L ●-SS
Social Interaction	○-SS ○-S		●-L		○				○-S ○-SS ○-L			
Public Health and Welfare			●-S ●-SS ●-L			●				●-L	●-S ●-SS	
Employment	○-S ○-SS ○-L				○				○-S ○-SS ○-L			
Population Growth	○-SS ○-S	●-L			○				○-SS ○-S	●-L		
Housing Quality	○-SS ○-S	●-L			○				○-SS ○-S	●-L		
Public Acceptance	○-SS ○-S		●-L		○				○-S ○-SS	●-L		
Land Use	○-SS ○-S			●-L	○				○-S ○-SS			●-L

KEY: ○-No Impact, ●-Adverse Impact, ☆-Beneficial Impact, S-Small WWTP with surface water discharge, SS-Small WWTP with subsurface discharge, L-Small WWTP with land discharge.

Summary (Table 58)

In order to summarize the total impact of each system alternative, the impact magnitude for each population component from the individual matrices was appropriately weighted to form a summary matrix. The weighting of the population components is necessary because the system alternatives impact each population component differently and because the size of components is different:

Population presently sewered	approximately 20,000
Population presently served by septic tanks	approximately 70,000
Future population	approximately 40,000

Therefore, the greatest weight in determining overall impacts was given to those impacts associated with actions affecting the largest population component, those people presently served by septic tanks.

TABLE 58. SUMMARY OF THE SOCIO-ECONOMIC IMPACTS OF THE ALTERNATIVE WASTEWATER TREATMENT SYSTEMS

Alternative	Cultural Resources	Social Interaction	Public Health & Welfare	Employment	Population Growth	Housing Quality	Public Acceptance	Land Use
1. All Septic Tanks	●	○	●	○	○	●	●	●
2. Septic Tanks and								
a. Existing WWTPs								
i. Surface water	●	○	●	○	○	○	○	○
ii. Subsurface	●●	○	●	○	○	○	○	○
iii. Land	●●	●	●	○	○	●	●	●
b. Expanded WWTPs								
i. Surface water	●	○	●●	○	○	○	●●	○
ii. Subsurface	●●●	○	●	○	○	○	●●	○
iii. Land	●●●	●	●●	○	●	●	●●●	●●●
6. Regional System	●●	●●●	☆	○	○	○	●●	○
7. Limited Regional								
System and								
a. Small WWTPs								
i. Surface water	●	○	●●	○	●	○	○	○
ii. Subsurface	●●	○	●	○	●	○	○	○
iii. Land	●●	●	●●	○	●	●	●	●●
b. Septic Tanks	●	○	●	○	○	○	○	○
c. Expanded Lines	●	○	●	○	○	○	○	○
8. 1st Phase Regional	●	○	●	○	○	○	○	○
9. No-Action								
i. Surface water	●	○	●	○	○	○	○	○
ii. Subsurface	●●	○	●	○	○	○	○	○
iii. Land	●●	●	●	○	●	●	●	●

KEY: No Overall Impact: ○
· Adverse Impact: ● -Minor, ●● -Moderate, ●●● -Significant
Beneficial Impact: ☆ -Minor, ☆☆ -Moderate, ☆☆☆ -Significant

6. EIS COORDINATION

6.1 Introduction

Public participation is an important part of the EIS process. It provides for active public involvement in developing and evaluating wastewater facilities and is required by federal regulations governing the preparation of environmental impact statements.

At the beginning of the Mill Creek Area EIS a public participation program was established to provide opportunities for interested groups, individuals and governmental agencies to participate in the development of the EIS. The focal point of this program was the establishment of a Citizen Review Committee. This group served in an advisory capacity to EPA and their consultant, GFC&C, Inc. Specific functions and duties of the group included:

- Identify local planning and environmental objectives
- Identify study area issues and conflicts regarding wastewater disposal and environmental conditions.
- Review all task report submissions.
- Assist in the development and evaluation of wastewater alternatives.
- Review Draft and Final Environmental Impact Statements.

The Citizen Review Committee has met at regular intervals throughout the development of the EIS. They have responded to reports prepared by EPA, provided local opinions on wastewater issues and developed for EPA and their consultant the needs and sensitivities of the study area.

In addition to the Citizen Review Committee, another vehicle for public participation was developed. This was in the form of a Technical Review Committee. The TRC was composed of local agencies and individuals who could provide technical review and assistance during the preparation of the EIS.

6.2 Coordination with Local, Regional, State, and Federal Agencies

Throughout the EIS process, it was necessary to contact many agencies - local, regional, state and federal - in order to gather data which aided in the preparation of the EIS. Table 59 is a listing of those agencies contacted, and the information made available by them for use in the EIS.

6.3 Public Participation Program

6.3.1 Background

In September 1977, EPA issued the Notice of Intent to prepare the Mill Creek Area EIS. The Notice of Intent indicated that the EIS would focus on

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TABLE 59. AGENCY CONTACT AND RESPONSES

METROPOLITAN SEWER DISTRICT
- Financial Information
- Utility Locations
- Construction Costs
- Operating Costs
- Plans and Maps

LOUISVILLE WATER COMPANY
- Billing Records
- Customer Location
- Water Use Info.
- Water Use Rates
- Location of Utilities
- Publications

JEFFERSON COUNTY PLANNING COMMISSION
- Publications
- Maps

JEFFERSON COUNTY/LOUISVILLE HEALTH DEPARTMENT
- Septic Tank Inspection Records
- Package Treatment Plant Inspections
- Private Well Water Analysis Info.
- Publications
- Reports

U.S. GEOLOGICAL SURVEY
- Maps
- Publications
- Ground Water Data

U.S. DEPARTMENT OF AGRICULTURE
- Soils Info.

CORPS OF ENGINEERS
- Water Levels for Ohio River
- Surface and Groundwater Quality - Publications

LOUISVILLE GAS AND ELECTRIC COMPANY
- Groundwater Quality Data

ATTORNEY GENERAL FOR COMMONWEALTH OF KY.
- Opinion on Several Point of KY. Law

PEDIATRIC VIROLOGY LAB
- Viral Isolates Locations

DEPARTMENT OF NATURAL RESOURCES, COMMONWEALTH OF KY.
- Water Quality Data
- Policy and Law
- Publications

JEFFERSON COUNTY PUBLIC WORKS DEPARTMENT
- Drainage Info.

JEFFERSON COUNTY OFFICE OF JUDGE
- Citizen Groups

specific controversial portions of the plan in the west county service area of Jefferson County, allowing other necessary and non-controversial portions of the plan to be implemented. The Notice indicated that during the course of implementing the 201 plan, controversy developed over the need for the sewer expansion in some residential areas currently served by individual on-lot disposal systems and over the provision of sewer service to the proposed Riverport Industrial Park. This Notice of Intent proposed that the EIS would consider present groundwater quality and current and future uses of the groundwater to determine the need for Federal funding of interceptor sewers to residential areas and the Riverport Industrial Park.

Subsequent to the issuance of this Notice to prepare an EIS, EPA received requests to expand the scope of the EIS. Notable among these requests was concern expressed by the Metropolitan Sewer District (MSD). MSD indicated that EPA's decision to prepare an EIS was a serious threat to the implementation of the 201 Plan. MSD requested that EPA either expand the EIS to include all of the Jefferson County 201 Planning area or provide written assurances that no additional EIS's would be required. During this same period EPA had received requests from the Southwest Jefferson County Homeowner's Association and other interested citizens to expand the scope of the EIS.

In November of 1977 EPA agreed to examine the requests to expand the EIS to cover the entire Jefferson County portion of the Water Quality Management Plan. To ensure that the public was aware of the discussions relative to scope and coverage of the EIS, EPA scheduled a public meeting for January 26, 1978. This meeting was to also serve the purpose of receiving input from the public and local agencies for consideration in defining the proper scope of the EIS. This public meeting was postponed as a result of inclement weather and was rescheduled for February 21, 1978. In the interim the Homeowner's Association filed Suit in the U.S. District Court to enjoin EPA and MSD from proceeding with implementation of the 201 Plan. Additionally, the Homeowners Association requested that a "full comprehensive Environmental Impact Statement be prepared for the Riverport Industrial Park, the West County Wastewater Treatment Plant, and connecting interceptors that are in the process of being constructed in Southwest Jefferson County, Kentucky." The February 1978 public meeting initiated the formal public participation activity of the EIS and was attended by over 150 people.

After consideration of the comments received at the February 1978 public meeting and other related concerns, EPA determined that the West County-Pond Creek System was cost-effective and environmentally sound and that a Negative Declaration was warranted. This Negative Declaration was issued on May 17, 1978.

EPA further resolved that significant controversy and unresolved issues surrounded the 201 Plan recommendations for the Mill Creek Basin portion of the West County area and a Notice of Intent to prepare an EIS on this portion of the 201 study area was issued on May 17, 1978. At issue in the Mill Creek Basin is the need for EPA to provide Federal funds for sewer service to residential areas currently served by individual on-lot disposal systems and the provision of sewer service to the Louisville-Jefferson County Riverport Industrial Park.

6.3.2 Review Committees

Introduction and Purpose

The establishment of a Citizen's Review Committee (CRC) was an important aspect of the Mill Creek Area Environmental Impact Statement Public Participation Program. The committee was formed with the express purpose of focusing the attention of local residents and other interested groups on the EIS. The committee consisted of 13 members and was representative of a cross-section of local interests. Each member of the group was asked to review and comment on all study materials, as well as to offer any other input during the course of the study. Several committee meetings were held throughout the study for review purposes. The contribution of the group was especially important in providing EPA with the information necessary to identify a preferred alternative.

The first major activity of the citizen participation program was an EIS workshop held on November 16, 1978 at the Pleasure Ridge Park High School. Over 200 area residents participated in this workshop. Two 30 minute television tapes were presented to the attendees which described the history of planned sewer expansions and related items within the Mill Creek Basin and discussed why the decision to prepare an EIS was made. At the end of these workshop presentations, local area citizens were given the opportunity to make comments and raise questions both orally and by filling out worksheets. Nominations for CRC members were also received at this workshop.

The first EIS newsletter reported the results of the EIS worksnop and was mailed in October 1978 to over 800 people and organizations located in the study area.

The second EIS newsletter was distributed in January 1979. This newsletter reported the results of the November 1978 workshop, reviewed project activities and requested additional nominations for CRC membership. Table 60 is a listing of EIS CRC members.

In addition to the CRC, another vehicle for public participation was developed in the form of a Technical Review Committee. Since sub-surface water and alternative methods of wastewater disposal were critical issues in the study area, it was felt that a technical committee composed of local agencies and technical groups should be developed to review data, provide technical input, and assist in developing a groundwater sampling program to determine subsurface water quality. Table 61 contains the list of the TRC committee members.

Public Participation Chronology

The first meeting of the CRC was held on March 27, 1979 at the Schaffner Elementary School. Agenda items included:

1. Introduction of committee members;
2. CRC functions;

TABLE 60. MILL CREEK AREA EIS CITIZEN REVIEW COMMITTEE

John Gray
Pleasure Valley Development Council

Margaret Loeb
Sierra Club

Francis Engdahl
Southwest Jefferson County Homeowners Association

Rubin Walker
Homeowners Association

Peggy Thompson
Intercom-Southwest

Edward Davis
Fred Butterworth
Southwest Business Association

Renee Butterworth
Barbara Jones
Valley Village Trustee

Art DeGrella
Pleasure Valley Optimist Club

Adonna Riley
National PTA

Jim Hearn
Pleasure-Valley Jaycees

Charles Blaud
Intercom - Southwest

Robert Klein
Kentucky League of Public Awareness

Pat Nightingale
League of Women Voters

TABLE 61. MILL CREEK AREA EIS TECHNICAL REVIEW COMMITTEE

Jim Fries
Joe Thornton
Kentucky for Natural Resources and Environmental Protection
Division of Water

Phillip Emery, District Chief
Water Resource Division
U. S. Geological Survey

Charles Weiter
Louisville and Jefferson County Health Department

Frank Christ
Louisville District-Corps of Engineers

Ed Meyers
Metropolitan Sewer District

Joe Schoenbachler
KIPDA

Dr. Stuart Neff
Water Resources Lab
University of Louisville

Larry McFall
Director of Engineering
Riverport Authority

Don Ridings
Jefferson County Environmental Policy Office

Andy Winfrey, Coordinator
Water Quality Advisory Board

3. CRC responsibilities;

4. the EIS plan of study;

5. review of the Project Background Task Report; and

6. review of the Interim Groundwater Report.

The first meeting of the TRC was also held on March 27 in Louisville's Federal Building. The agenda was similar to the CRC meeting agenda.

In June 1979, the third EIS newsletter was prepared which reviewed the activities of the March committee meetings, project activities, listed the CRC members and presented profiles of several CRC members. This newsletter also designated the Newman Memorial Library and the Southwest Branch Library as depositories for project reports. Citizens were encouraged to review documents at these two locations.

The second CRC meeting was held on June 13, 1979, at the Southern Federal Savings and Loan Building on Dixie Highway. Agenda items included:

1. committee function, structure and organization;

2. project schedule;

3. the development of EIS alternatives; and

4. the alternatives Development workshop.

The fourth EIS newsletter was distributed in July 1979. This newsletter reviewed project activities, advertised the July 24 alternatives development workshop and presented profiles of several CRC members.

The first Alternatives Development Workshop was held on July 24, 1979 at the Pleasure Ridge Park High School. The purpose of this workshop was to allow for the development of a full range of alternatives for wastewater management within the Mill Creek Basin Study Area and to discuss factors which constrain or limit the selection of alternatives.

This workshop was the first element of the alternatives development process and included a discussion of conventional and alternative options regarding wastewater collection, treatment and disposal. Small area, regional and on-site methods were discussed and people attending the workshop were asked to complete worksheets, voice opinions and make suggestions of alternatives for evaluation.

Approximately 65 area residents attended the workshop and actively participated in the program. Questions from the workshop attendees were entertained and the majority of these questions dealt with the need for sewers within the Mill Creek Area.

After the question and answer period presentations were made by study team members which described a range of methods available for possible use in the study area. "Constraints" or factors which might limit the further consideration of an alternative were also presented and discussed. Attendees filled out worksheets and these worksheets were used in a preliminary screening of alternatives to determine those warranting detailed evaluations.

A "Wastewater Alternatives Development Handbook" was developed and used to collect citizen perceptions. The results of the workshop worksheets were presented in the fifth EIS Newsletter (dated September 1979) and incorporated into the alternatives evaluation and development process.

The third CRC meeting was held at the Southern Federal Savings and Loan Building on September 20, 1979. The topics of discussion included:

1. the results of the first Alternatives Development Workshop;
2. the conduct of the second Alternatives Development Workshop;
3. the EIS Environmental Inventory Draft Task Report;
4. the Alternatives Development Process; and
5. the project schedule.

The fourth CRC meeting was held on November 1, 1979, at which time the Environmental Inventory Draft Task Report was reviewed in detail. The agenda for the second Alternatives Development Workshop was also discussed.

As a follow-up to the first Alternatives Development Workshop a second Alternatives Development Workshop was held on November 13, 1979.

The agenda for this workshop included:

1. results of prior workshop;
2. presentation of baseline inventory;
3. description of sub-area planning units;
4. description of alternative components;
5. discussion of advantages and disadvantages of each alternative;
6. presentation of preliminary screening results; and
7. public comment and perceptions.

Approximately 60 area residents attended this workshop and actively participated in the program. Fact sheets covering each of the reasonable alternatives for areas that are either sewered or unsewered were used to help citizens better understand the physical and operational constraints of each alternative.

The sixth EIS Newsletter was issued in January 1980. This newsletter reported the results of the November workshop and noted the availability of the EIS Alternatives Development Draft Task Report.

The fifth CRC meeting was held on January 29, 1980, at which time the Alternatives Development Draft Task Report was reviewed in detail. The alternatives evaluation process was also outlined and discussed. The second TRC meeting was also held on January 29, with a similar agenda.

In May 1980, the seventh EIS newsletter was issued. This newsletter dealt exclusively with the EIS Groundwater Program. All elements of the Groundwater Program, including the purpose, the well sites, the parameters sampled, the sampling schedule, the results, and the conclusions were discussed in the newsletter.

The sixth CRC meeting was also held during May 1980. The meeting agenda included:

1. the groundwater Program Draft Task Report;
2. a review of EIS System Alternatives; and
3. a discussion of the alternatives evaluation process.

The third TRC meeting covered similar agenda items.

In September of 1980 the alternatives developed for final evaluation were presented in the eighth EIS Newsletter. These alternatives and sub-alternative components were presented in summary form and included maps. This information was prepared as a part of a background presentation for a public meeting on the evaluation of Wastewater Management Alternatives held on December 16, 1980. The purpose of this meeting was to present the alternatives evaluation process and results to the public and to receive community comments. The public meeting was attended by about 100 people.

As a prelude to this public meeting a 30 minute television tape was prepared and shown on all the local Louisville TV stations one week prior to the meeting. The purpose of this television tape was to promote the meeting, provide project background information and to present the final alternatives for review and consideration. Another television tape was prepared and shown at the public meeting. The purpose of this presentation was to present the preliminary results of the evaluation process and to encourage citizen responses and questions concerning the alternatives and the evaluation process.

In June 1981, a Mill Creek Area EIS Preliminary Decision Paper was prepared and issued for public and local agency review. The Decision Paper indicated EPA's preliminary decision of a Draft EIS preferred alternative and the basis for this decision. The Decision Paper was the subject of discussion for a series of meetings with local agencies (MSD, Health Department, Environmental Policy Office, and the Kentucky Department for Natural Resources and Environmental Protection) and a joint Technical/Citizens Review Committee meeting in June 1981.

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REFERENCES

Arbuckle, Alan. 1980. Wellwater Area in Southwest Jefferson County, Louisville Water Company.

Brown, E. L. 1950. Deciduous Forests of Eastern North America. Macmillan, New York.

Clay, W. M. 1975. The Fishes of Kentucky. Kentucky Department of Fish and Wildlife Resources, Frankfort, Ky. 416 pp.

Collins, M. B., ed. In preparation. Excavations at Four Archaic Sites in Southwest Jefferson County, Kentucky. Report to be filed with the Interagency Archaeological Service and the U.S. Corps of Engineers, Louisville District.

Fitzpatrick, J. F. Jr. 1967. The Propinquus group of the Crawfish genus *Orconectes* (Decapoda: Astacidae). Ohio J. Sci. 67:129-172.

Gunn, C. R. 1966. The flora of Jefferson and seven adjacent counties, Kentucky. Annals of Ky. Soc. Nat. His. 2:1-322.

Harker, D. F., Jr. 1980. Director, Kentucky Nature Preserves Commission. Personal communication (letter), July.

Kentuckiana Regional Planning and Development Agency (KIPDA). 1974. Water Quality Management Plan, Vol. 1 & 2. Louisville.

KIPDA. 1978. KIPDA 208 Areawide Waste Treatment Management Plan. Louisville.

Louisville and Jefferson County Planning Commission (LJCPC). 1973. Outdoor Recreation Plan.

LJCPC. 1978. KIPDA 208 Areawide Waste Treatment Management Plan. Vol. II: Land Use Planning. Prepared for the Kentuckiana Regional Planning and Development Agency, Louisville.

Ohio River Valley Water Sanitation Commission (ORSANCO). 1962. Aquatic-Life Resources of the Ohio River. Cincinnati. 218 pp.

Price, W. E., Jr. 1964. Geology and Hydrology of Alluvial Deposits Along the Ohio River Between Southwestern Louisville and West Point, Kentucky. U.S. Geological Survey. Hydrologic Investigations Atlas HA-111.

Raven, J. E. 1971. Letter *in* Final Environmental Statement, Local Flood Protection Project, Southwest Jefferson County, Kentucky. U.S. Army Corps of Engineers, 1973, Louisville.

Schimpeler-Corradino Associates. 1974. Water Quality Management Plan. Prepared for the Kentuckiana Regional Planning and Development Agency, Louisville.

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REFERENCES (Cont.)

Stephens, C., and J. Durell. 1979. Endangered and Rare Species in Kentucky. Manuscript obtained from Ky. Game & Fish office, Frankfort.

Swigart, J. 1980. Secretary, Kentucky Department for Natural Resources and Environmental Protection. Letter to Rebecca Hanmer, EPA Region IV Administrator, October 8, 1980.

Terhune, J. D. 1975. Water Quality Study of Beargrass Creek, Jefferson County, Kentucky. Thesis, University of Louisville, Ky.

U.S. ACE. 1978. Preliminary Guide to the Wetlands of the Gulf Coastal Plain. Technical Report No. Y-78-5. Waterways Experiment Station, Vicksburg, Miss.

U.S. ACE. 1980. Personal communication with Mike Turner, Louisville District.

U.S. Bureau of the Census. 1972. 1970 Census of Population and Housing: Louisville, Kentucky, Standard Metropolitan Statistical Area. Report No. PHC(1)-118. Washington, D.C.

U.S. Environmental Protection Agency. 1974. Design Criteria for Mechanical, Electric, and Fluid System and Component Reliability. Report No. MCD-05, EPA-430-99-74-001. Washington, D.C.

U.S. Environmental Protection Agency. 1977. Process Design Manual for Land Treatment of Municipal Wastewater, EPA-625/1-77-008. Washington, D.C.

U.S. Forest Service. 1965. Silvics of Forest Trees of the United States. U.S. Dept. Agriculture Handbook No. 271.

U.S. Soil Conservation Service (SCS). 1966. Soil Survey--Jefferson County, Kentucky.

Vollmer-Presnell-Pavlo (VPP). 1976. MSD Master Plan Expansion Program, Environmental Assessment.

Weaver, J. B. 1973. Cost and profitability estimation, in Chemical Engineers' Handbook (R. H. Perry and C. H. Chilton, eds.). McGraw-Hill, New York.

Williams, J. C. 1969. Mussel Fishery Investigation--Tennessee, Ohio and Green Rivers--Final Report. Kentucky Department of Fish and Wildlife Resources, Frankfort. 106 pp.